electronicsForYou EXPRESS

FEBRUARY 2023
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MUST READ

- "The IoT Market Has The Potential For 50-60 Billion Units A Year In The Next Decade"—Matt Johnson, Silicon Labs
- Managing E-Waste Of EV Batteries: A Challenge As Well As Opportunity
- The Thing That Generates Cash-Flow
- 5 Interesting Reference Designs For Medical And Environment Sensing Applications

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in 2023
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Everyone Whether
Big Or Small
IoT Startups: How
Crucial Is This Decade?
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Provider Is A Partner
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From Idea To Reality:
An Unusual Journey
MY STORY:
LIFE IS NOT
A SPRINT,
IT IS A
MARATHON
MANISH SHARMA
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ent14

thanks for asking.
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it's an e-zine. we don't print it.

we publish only select editorial from the main magazine in XP.

plus, we publish all the ads from the main magazine along with those booked for XP.

WHY?
it's a typical FREEMIUM offering where you get to read our content (some of it) for free, and if you like it and want all of it, you pay for the print or ezine edition of the main magazine.

we publish all ads of the magazine

DOES IT HELP?
oh yes!

we have seen subscriptions of the print and ezine editions go up month-over-month since the launch of XP in Oct 2020.

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last 4 editions of XP witnessed average readership crossing 2-plus lakhs on our website alone!

XP also attracts readers through JioMags, Magzter, Facebook and LinkedIN on top of those who read it on our website.

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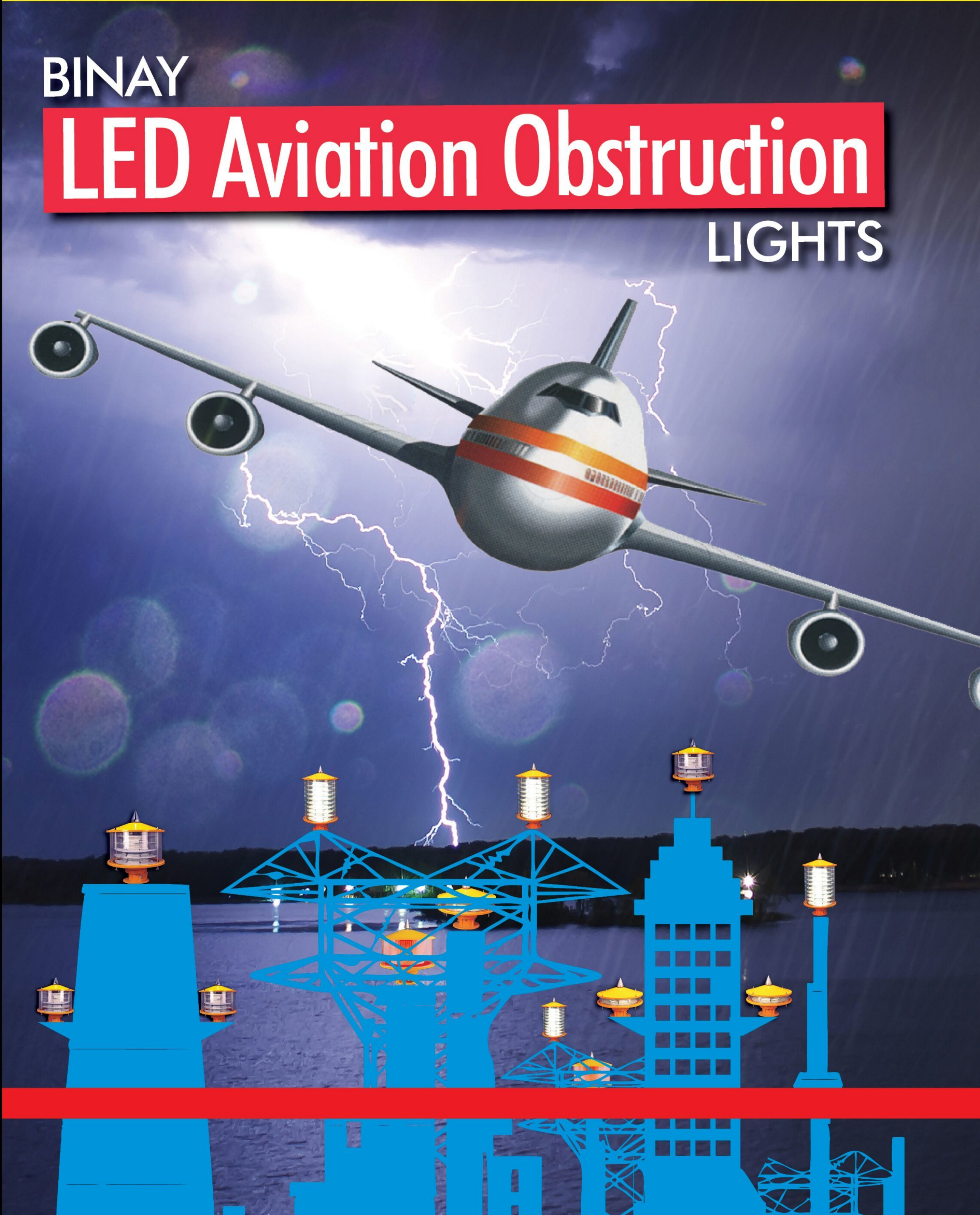
PROVIDING LED POWERED

BINAY LED Aviation Obstruction LIGHTS



TECHNOLOGIES SINCE 1983

BINAY LED-based HIGH, MEDIUM and LOW Intensity Aviation Obstruction Light Beacons

As per International Civil Aviation Organisation (ICAO) requirements Available in Low Intensity, Medium Intensity and High Intensity versions (as per International Civil Aviation Organization guidelines), BINAY's patented LED Aviation Lights come with 5-year/3-year warranties

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(Flashing Red
OR Fixed Red LEDs)

All BINAY Aviation Lights are based on Non-switching passive type circuitry (NO SMPS)

The circuitry incorporated inside the LED Aviation Obstruction Lights is passive electronic (solid-state) in nature, and does not use internal SMPS driver switching units to control the light unit. Internal LED current control is by non-switching electronic means only. No electrolytic capacitors are used inside the Aviation Obstruction Light unit.

The above is necessary to ensure reliability of the LED Aviation Obstruction Light. This system design effectively eliminates any active components and circuits inside the aviation light itself, and enhances the solid-state passive reliability of the LEDs (mounted in relatively inaccessible locations at the height of tall structures). This drastically reduces the possibility of component failure - and hence possibility of any maintenance requirement – in the LED Aviation Obstruction Lights themselves (which are mounted at extreme heights in the system).

The BINAY LED Aviation Obstruction Light offers the following advantages:

- Fit-and-forget maintenance-free operation
- A long life of 100,000 hours (20 years at 12 hours daily burning)
- Pays for itself within a short period of operation in the form of reduced installation, maintenance and servicing costs
- Quick Installation; Reliable operation 365 days per year
- Shock-proof and vibration-resistant
- Over-Designed Intensity to allow for natural LED intensity degradation over its operating lifetime

LED Obstruction Lighting for:

- Industrial chimneys and smokestacks
- Transmission, microwave and cellular towers
- Radio, TV and similar structural towers
- High-rise buildings and structures
- Airports and airfields

THE BINAY LED OBSTRUCTION LIGHT IS UNDER ACCEPTED PATENT, AND AS SUCH IS A PROPRIETARY PRODUCT

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FEBRUARY 2023 | VOL. 3 NO. 4

CONTENTS

TECHNOLOGY

24 INTERVIEW: "The IoT Market Has The Potential For 50-60 Billion Units A Year In The Next Decade" — Matt Johnson, President and CEO, Silicon Labs

32 TREND: How To Protect Against Credit And Debit Cards' Hacking

STRATEGY

40 DESIGN: Ensuring Quality Product By Quality Function Deployment

50 OPPORTUNITY: Managing E-Waste Of EV Batteries: A Challenge As Well As Opportunity

58 GROWTH: The Thing That Generates Cash-Flow

DESIGN

66 CIRCUIT: 5 Interesting Reference Designs For Medical And Environment Sensing Applications

DO-IT-YOURSELF

68 PROJECT: ESP32 As Camera Webserver

REGULARS

10 **From You:** Your Suggestions and Things You Wanted To Know!
11 **Research & Innovation Updates**
16 **Truly Innovative Electronics**
18 **New Products**
38 **Dashboard:** Key Industry Trends That Can Shape The Future Of Your Business
54 **Startups & Innovators**
61 **Industry News:** Industry Updates

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startups SPECIAL
OptimusLogic Systems Indigenising 5G Communication With Optimus Rhino 5G
ARISTA VAULT Integrating Electronics With Fashion And Luxury
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TECHNOLOGY

21 TREND: Hybrid PV And Thermoelectric Device To Harvest Solar Energy More Efficiently

36 AUTOMATION: How IoT Can Make The Workplace Intelligent

48 TREND: Portable Power Stations: A New Breed Of Decentralised Energy Storage Products

DESIGN

77 CHIP: Accelerators For Cameras And Audio Applications

DO-IT-YOURSELF

82 PROJECT: Coal Mining Safety Robot To Monitor Environment And Stop Fires

86 CIRCUIT IDEA: Power Supply For A Clock Using Supercapacitor And Small Solar Panels

91 PROJECT: A Python Based GUI For AM Modulation

94 PROJECT: World's First Programmable Smart Watch With Fitness Tracking

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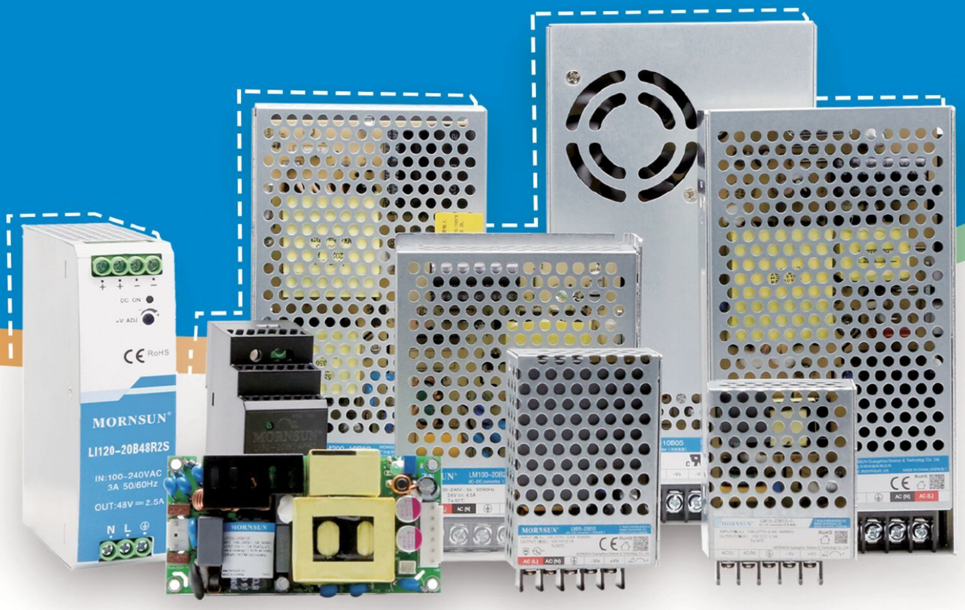
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FROM YOU

YOUR SUGGESTIONS AND THINGS YOU WANTED TO KNOW!

THERMAL CONTROL FOR EV

This is regarding the ‘Thermal Management System for Electric Vehicles’ DIY article published in January issue. I have a 3.2V, 25Ah LiFePO4 battery which I need to charge with a laptop charger. How should I modify the circuit to get 3.6V, 10A output using a 19V, 3.42A laptop charger?

Kishok

EFY. You should not try to modify a laptop charger to charge a 3.2V, 25Ah LiFePO4 battery. The charger is not designed for this purpose and doing so could damage the battery or the charger. LiFePO4 batteries require a specific type of charger that can provide the correct voltage and current for charging. Attempting to modify a laptop charger could result in overcharging or undercharging the battery, which can be dangerous and can shorten the lifespan of the battery. It is recommended to use a charger specifically designed for LiFePO4 batteries to charge this type of battery.

• • •

REAL-TIME ECG

This is regarding the ‘Handheld Real-Time ECG Measurement System’ DIY article published in November issue. I have downloaded the recommended source code for the ECG measurement system, but on uploading the code to Arduino Uno, following error is displayed:

```
Compilation error: ‘Arduino’ does not
name a type; did you mean ‘Arduino_h’?
C:\Users\xxx\Documents\Arduino\ECG_code\
ECG_code.ino:1:1: error: ‘intecg’ does
not name a type; did you mean ‘int8_t’?
intecg = 0;
^~~~~~
int8_t
C:\Users\user\Documents\Arduino\ECG_code\
ECG_code.ino: In function ‘void loop()’:
C:\Users\user\Documents\Arduino\ECG_code\
ECG_code.ino:18:22: error: ‘ecg’ was not
declared in this scope
Signal = analogRead(ecg);
^~~
C:\Users\user\Documents\Arduino\ECG_code\
ECG_code.ino:25:4: error: ‘Else’ was not
declared in this scope
 Else
 ^~~~
exit status 1
```

Sabu

EFY. The recommended source code was compiled and tested. The picture of the code snippet published was for reference and not the complete code for copying as the main code. You can download the complete code from the website-stated link on the project page and use that for compilation. The picture of the Arduino code states that following is the Arduino code pic; this sentence is not a part of the code - it is just a statement. You need to put space between int and ecg. Also note that Arduino compiler is case-sensitive. Use the picture just for reference; it is not the full code. Download the correct code from the link *https://www.electronicsforu.com/electronics-projects/real-time-handheld-ecg-display*

• • •

SMART GLASSES

This is regarding the ‘Smart Glasses Like Google Glass Made With OLED Display’ DIY article published in November issue. Can you provide a detailed video of the project showing the connections and working of the project?

Divyanshu

EFY. You can check the video of the published project on electronicsforyou.com using the link *https://www.electronicsforu.com/category/videos-slideshows/videos*

• • •

WATER FLOW METER

We are trying to build a water flow meter for our graduation project but are stuck with the project in absence of any guidance. We have purchased the MHT, water flow meter, and the pressure sensor but are not getting the calculations right. These have been installed on a pipe where we have a valve to control the water flow. When we measure the voltage the digital multimeter shows 1.3 microvolts and no current is detected. We have used an Arduino board and installed the program on desktop to get pressure and water flow measurements, but we are not getting any output. Can you please help?

Jude Safarjal

EFY. Please refer the DIY article ‘Digital Flow Meter For Water Pipes’ published in August issue. It is also available at *https://www.electronicsforu.com/electronics-projects/digital-water-flow-meter*

• • •

HEALTH RING

How can I contact you bro? I and my team want to discuss your project ‘A Futuristic Wearable Health Monitoring Ring’ published in October issue.

Santhosh M.

EFY. You can discuss on our following online forum to clear your doubts: *https://www.electronicsforu.com/forums* or you can write to us on our email ID *efyeditop@efy.in*

ERROR MESSAGE

I get the following error message while installing OpenCV:

```
ERROR: No matching distribution found
for opencv
When running the command sudo pip3
install opencv
```

What should I do?

Prashant

EFY. You get this error because of version conflict with OpenCV. Try the following command:

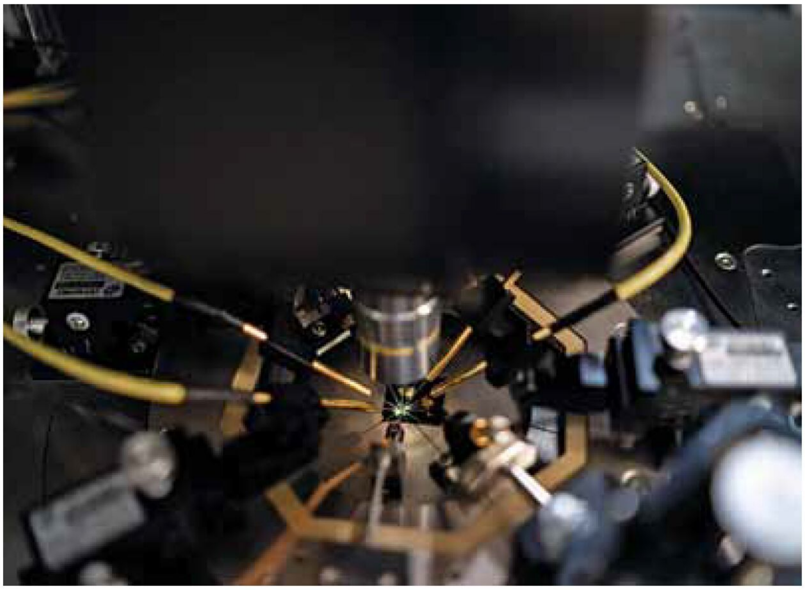
```
sudo pip3 uninstall open cv
sudo pip3 install opencv-python
```

Letters and questions for publication may be addressed to Editor, Electronics For You, D-87/1, Okhla Industrial Area, Phase 1, New Delhi 110020 (e-mail: **onedit@efy.in**)

RESEARCH
& INNOVATION UPDATES

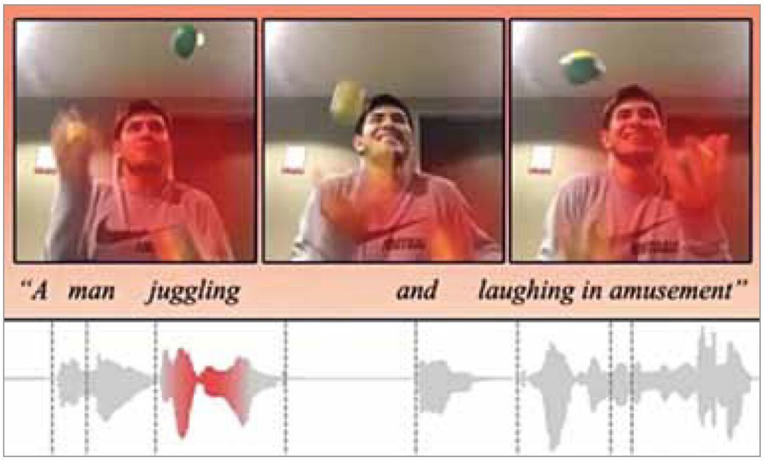
Deep belief neural network made based on silicon memristive synapses

Researchers at Technion-Israel Institute of Technology and the Peng Cheng Laboratory have recently created a new neuromorphic computing system supporting deep belief neural networks (DBNs), a generative and graphical class of deep learning models. This model is based on silicon based memristors, which are energy-efficient devices that can both store and process information. The artificial synapses were fabricated using commercial complementary-metal-oxide-semiconductor (CMOS) processes. These silicon based synapses have numerous advantageous features, including analogue tunability, high endurance, long retention time, predictable cycling degradation, and moderate variability across different devices. The results showed over 97% accurate recognition of handwritten digits when using Y-Flash based memristors.



Memristors measured in a probe station (Source: https://techxplore.com)

AI system learns concepts shared across video, audio, and text

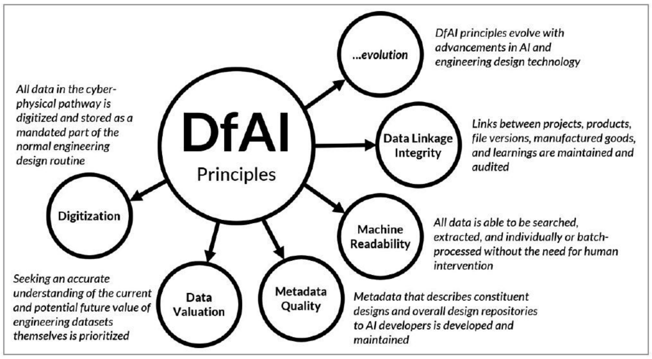


MIT researchers developed a machine learning technique that learns to represent data in a way that captures concepts which are shared between visual and audio modalities. Their model can identify where certain action is taking place in a video and label it (Source: https://scitechdaily.com)

Visual learning is considered a highly efficient way to understand a concept. Researchers at the Computer Science and Artificial Intelligence Laboratory (CSAIL) have developed an artificial intelligence (AI) technique that allows machines to learn concepts shared between different modalities, such as videos, audio clips, and images. The model learns to represent data in a way that captures concepts which are shared between visual and auditory modalities. The work focuses on representation learning, which is a form of machine learning that seeks to transform input data to make it easier to perform a task like classification or prediction. The model still has some limitations that need to be addressed. For one, their research focused on data from two modalities at a time, but in the real world humans encounter many data modalities simultaneously.

Design for AI engineering framework developed

Researchers from Carnegie Mellon University have developed a Design for Artificial Intelligence (DfAI) framework in collaboration with researchers at Penn State University to educate and encourage the academic and industrial engineering community to adopt AI engineering design. The team outlines three personas as necessities for DfAI: engineering designers, design repository curators, and AI developers. An engineering designer may be a person or team responsible for developing the specifications of a new project. They are the problem solvers who can understand the engineering constraints as well as the AI algorithms. Design repository curators must take the role of a database maintainer one step further by having engineering design and manufacturing knowledge to deliver design engineers the data management tools to meet workflow demands and be extensible to future demands. Finally, the AI developers must be able to ideate, develop, market, and continuously improve AI software products to help the design engineers.


DfAI
Principles
...evolution
DfAI principles evolve with advancements in AI and engineering design technology
Data Linkage Integrity
Links between projects, products, file versions, manufactured goods, and learnings are maintained and audited
Machine Readability
All data is able to be searched, extracted, and individually or batch-processed without the need for human intervention
Metadata Quality
Metadata that describes constituent designs and overall design repositories to AI developers is developed and maintained
Data Valuation
Seeking an accurate understanding of the current and potential future value of engineering datasets themselves is prioritized
Digitization
All data in the cyber-physical pathway is digitized and stored as a mandated part of the normal engineering design routine

DfAI Principles (Credit: Carnegie Mellon Unviersity, College of Engineering)

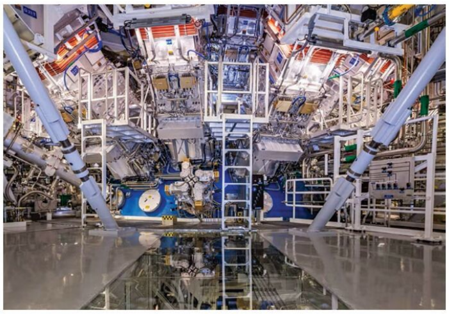
A watch that works only when attached organism is healthy

Researchers at University of Chicago wondered if they could change that fickle relationship by bringing devices to life—literally. They used the electrically conductive single-cell organism known as "slime mold" to create a watch that works only when the organism is healthy, requiring the user to provide it with food and care. The organism is placed in an enclosure on the watch, and the user must regularly feed it a mixture of water and oats to induce its growth. When it reaches the other side of the enclosure, it forms an electrical circuit that activates the heart rate monitor function. When tested, researchers found a high level of attachment to the watch, with some users saying it felt like a pet—even naming it or putting their partner in charge of the feeding when they got sick. This also depicted the users' emotional response when they were asked to neglect the organism, expressing guilt or even grief.

UChicago researchers have created a watch powered by slime mold—which has to be fed and cared for to work (Credit: HCintegration)

Fusion reaction generates more energy than used to create it

A team of researchers at the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory have achieved success in producing more energy than the laser pulse that was used to heat the fuel. The NIF focused on inertial confinement fusion, which uses a system of lasers to heat up fuel pellets producing a plasma—a cloud of charged ions. The fuel pellets contain "heavy" versions of hydrogen—deuterium and tritium—that are easier to fuse and produce more energy. However, the fuel pellets need to be heated and pressurised to conditions found at the centre of the Sun, which is a natural fusion reactor. Once these conditions are achieved, fusion reactions release several particles, including alpha particles, which interact with the surrounding plasma and heat it up further. The heated plasma then releases more alpha particles and so on, in a self-sustaining reaction—a process referred to as ignition.



Fusion energy creation (Credit: Imperial College London)

New technique found to simplify qubits manufacture

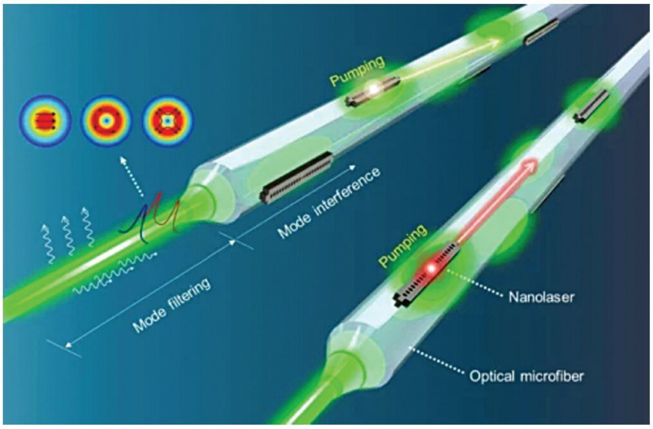
Scientists from Japan have discovered how a superconducting material, niobium nitride, can be added as a flat, crystalline layer to a nitride-semiconductor substrate. This technique could make it simple to manufacture quantum qubits that can be used with conventional computer devices. Niobium nitride can become superconducting at temperatures 16°C above absolute zero. Thus, it can be utilised to create a superconducting qubit when arranged in a structure called a Josephson junction. Researchers investigated the impact of temperature on the crystal structures and electrical properties of NbNx thin films grown on AlN template substrates. They showed that the spacing of atoms in the two materials was compatible enough to produce flat layers. This interface between the AlN substrate, which has a wide bandgap, and NbNx is essential for future quantum devices, such as Josephson junctions. Superconducting layers that are only a few nanometers thick and have high crystallinity can be used as detectors of single photons or electrons.

New technique found to improve free-space optical communication

New signal-processing algorithms have been shown to mitigate the impact of turbulence in free-space optical experiments, potentially bringing "free space" internet a step closer to reality. A team of researchers from Aston University's Aston Institute of Photonic Technologies and Glasgow University used commercially available photonic lanterns, a commercial transponder, and a spatial light modulator to emulate turbulence. They simultaneously transmitted multiple data signals using different spatially shaped beams of light using a so-called photonic lantern. Turbulence changes the shape of the beams, often losing the signal if only a single simple shape is transmitted and detected, but by detecting light with these shapes using a second lantern, more of the light is collected at the receiver, and the original data can be unscrambled. This can greatly reduce the impact of the atmosphere on the quality of the data received in a technique known as Multiple-Input Multiple-Output (MIMO) digital signal processing. This project aims to provide the internet performance of a pure fibre connection without the need to install cables.

New optical approach can enable much faster communication

A new all-optical approach for driving multiple highly dense nano laser arrays has been developed by researchers in Korea. This method can enable chip based optical communication links that process and move data much faster than current electronic based devices. Researchers have demonstrated that densely integrated nano laser arrays—in which the lasers are just 18 microns apart—can be fully driven and programmed with light from a single optical fibre. Researchers used electrodes with a unique optical driver that creates programmable patterns of light via interference. This light travels through an optical fibre onto which nano lasers are printed. To demonstrate this approach, the researchers used a high-resolution transfer-printing technique to fabricate multiple photonic crystal nano lasers spaced 18 microns apart. These arrays were applied onto the surface of a 2-micron-diameter optical microfibre. The interference pattern could also be modified by adjusting the driving beam's polarisation and pulse width. The design allowed multiple nano laser arrays to be driven using light traveling through a single fibre.



Researchers have developed a new all-optical method for driving multiple high-density nanolaser arrays using light traveling down a single optical fibre. The optical driver creates programmable patterns of light via interference (Credit: Myung-Ki Kim, Korea University)

ML model to predict earthquakes and pandemics developed

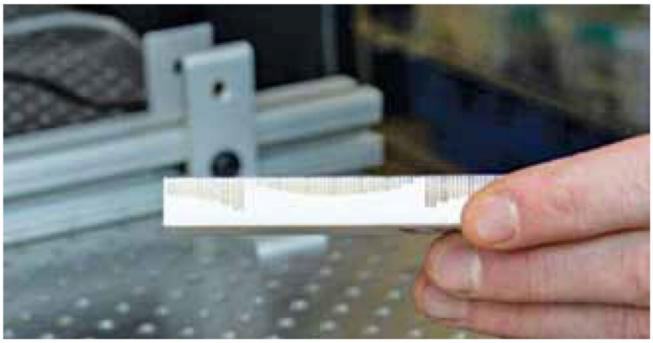
Researchers at Brown University and MIT have developed a machine learning model that can predict an upcoming natural calamity like earthquakes and pandemics. They combined statistical algorithms—which need less data to make accurate, efficient predictions—with a powerful machine learning technique and trained the model to predict scenarios, probabilities, and sometimes even the timeline of rare events despite the lack of historical record on them. Researchers applied the pinpointing parameter and different ranges of probabilities for dangerous spikes during a pandemic, finding and predicting rogue waves, and estimating when a ship will crack in half due to stress. They found they could discover and quantify when rogue waves will form by looking at probable wave conditions that nonlinearly interact over time, leading to waves sometimes three times their original size.

Flaws in lithium-ion batteries being studied to improve them

An international group of experts, led by researchers from Texas A&M University, have combined powerful imaging techniques and large data sets to better understand why lithium-ion batteries fail and how they can be improved. Researchers were able to visualise the flaws and map defects that occur within the batteries using the SM beamline at the Canadian Light Source (CLS)—located at the University of Saskatchewan (UofS). The team is interested in identifying in real time the flaws that occur, which would allow them to measure the complex relationship between the battery's materials, its shape, and the chemical reactions that occur within. Reaching this goal would allow researchers to proactively address design failures. More efficient batteries can help reduce waste and help us transition to a greener grid.

Objects steered with the help of ultrasonic waves

Researchers at University of Minnesota have developed a way to freely manipulate objects with the help of ultrasound waves. Their method can move larger objects using the principles of metamaterial physics. Metamaterials are artificially designed materials that can interact with waves like light and sound. By placing a metamaterial pattern on the surface of an object, the researchers were able to use sound to steer it in a certain direction without physically touching it. When these tiny patterns are placed on the surface of the objects, one can basically reflect the sound in any direction. And in doing that, the user can control the acoustic force that is exerted on an object. Using this technique, the researchers can not only move an object forward but also pull it toward a source—not too dissimilar from the "force" described in Star Wars.



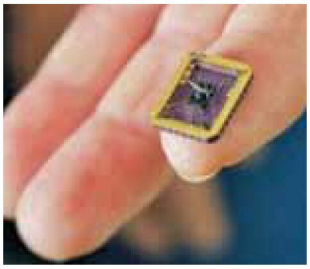
By placing a metamaterial pattern on the surface of an object, the University of Minnesota researchers were able to use sound to steer it in a certain direction without physically touching it (Credit: Olivia Hultgren)

A new system devised to teach deep learning more efficiently

Researchers at Texas A&M University, Rain Neuromorphics, and Sandia National Laboratories have devised a new system for training deep learning models more efficiently and on a larger scale. This approach could reduce the carbon footprint and financial costs associated with the training of AI models, thus making their large-scale implementation easier and more sustainable. To do this, they had to overcome two key limitations of current AI training practices. The first challenge was the use of inefficient hardware systems based on GPUs, whereas the second entails the use of ineffective and math-heavy software tools, specifically utilising the so-called backpropagation algorithm. Researchers developed a new co-optimised learning algorithm that exploits the hardware parallelism of memristor crossbars. This algorithm, inspired by the differences in neuronal activity observed in neuroscience studies, is tolerant to errors and replicates the brain's ability to learn even from sparse, poorly defined, and "noisy" information.

Unique nano chips formed using silicon carbide chips

Researchers at the Georgia Institute of Technology have created a modified form of epigraphene on a silicon carbide crystal substrate to create a new nanoelectronics platform. They produced unique silicon carbide chips from electronics-grade silicon carbide crystals. They used electron beam lithography, a method commonly used in microelectronics, to carve the graphene nanostructures and weld their edges to the silicon carbide chips. This process mechanically stabilises and seals the graphene's edges, which would otherwise react with oxygen and other gases that might interfere with the motion of the charges along the edge. Results showed that the graphene edge states were similar to photons in an optical fibre that can travel over large distances without scattering. They found that the charges traveled for tens of thousands of nanometres along the edge before scattering.



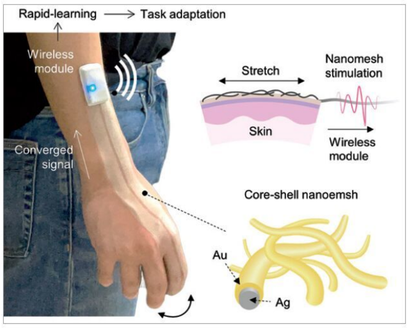
Claire Berger, physics professor at Georgia Tech, holds the team's graphene device grown on a silicon carbide substrate chip (Credit: Jess Hunt-Ralston, Georgia Tech)

Eco-friendly wirelessly powered IoT sensors on the way

KAUST alumni Kalaivanan Loganathan, with Thomas Anthopoulos and coworkers, assessed the viability of various large-area electronic technologies and their potential to deliver eco-friendly, wirelessly powered IoT sensors. He has developed a range of RF electronic components, including metal-oxide and organic polymer based semiconductor devices known as Schottky diodes. "These devices are crucial components in wireless energy harvesters and ultimately dictate the performance and cost of the sensor nodes," Loganathan says. Key contributions from the KAUST team include scalable methods for manufacturing RF diodes to harvest energy reaching the 5G/6G frequency range. Such technologies provide the needed building blocks toward a more sustainable way to power the billions of sensor nodes in the near future. The team is currently working on the monolithic integration of these low-power devices with antenna and sensors to showcase their true potential.

Spray-on sensory system makes hands smarter

Researchers from Stanford University have developed a spray-on sensory system which consists of printed, bio-compatible nanomesh directly connected with a wireless Bluetooth module and further trained through meta-learning. The device can identify objects by touch alone or allow users to communicate by hand gestures with apps in immersive environments. The spray-on approach enables the device to function without any need of a substrate. This decision eliminated unwanted motion artifacts and allowed them to use a single trace of conductive mesh to generate multi-joint information of the fingers. The device functions on the basis of a machine learning algorithm. Computers monitor the changing patterns in conductivity and map those changes to specific physical tasks and gestures. To meet this intense computational challenge and the need to compute vast amounts of data, the Stanford team has developed a learning scheme that is far more computationally efficient.



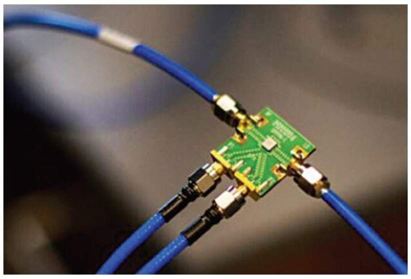
Spray-on sensory system which consists of printed, bio-compatible nanomesh directly connected with wireless Bluetooth module and further trained through meta-learning (Credit: Kyun Kyu Richard Kim, Bao Group, Stanford U.)

Earbuds shown to work as hearing aids much more economically

Recent studies have demonstrated the effectiveness of earbuds in case of hearing loss. According to these studies, commercial earbuds can be adapted as hearing aids in amplifying sound for individuals with hearing loss. One such study was conducted by a team of researchers led by Yen-fu Cheng, an otolaryngologist at Taipei Veterans General Hospital. The team compared AirPods 2 and AirPods Pro—the model with a noise canceling feature—with a set of premium hearing aids and a basic pair of hearing aids. Notably, AirPods Pro met four out of five technology standards for hearing aids. It was also observed that both AirPods models were far cheaper than the basic as well as the premium hearing aids.

Wireless communication at terahertz speed shown over large distances

Researchers have proved that high-speed, high-bandwidth wireless communication at the terahertz frequency is possible across long distances. Their work shows that there is a path forward for mass wireless communication, one that could shrink the digital divide felt by rural communities outside high-speed optical fibre networks. Researchers were able to form a 2km link, the longest terahertz connection ever established on Earth. The team directly fed the information to the signal source. The results showed that the new system was hitting frequencies and bandwidths that eclipsed 5G networks by more than "two orders of magnitude." The impact of this kind of high-speed, high bandwidth connection would be monumental, providing higher data rates and more connectivity even for rural communities.



Josep Jornet, an associate professor of electrical and computer engineering at Northeastern, proved it is possible to maintain a two kilometre-long connection using high frequency terahertz technology (Credit: Matthew Modoono, Northeastern University)

Solar reactor converts plastic and greenhouse gasses to fuel

Researchers at the University of Cambridge have developed a system that can transform plastic waste and greenhouse gasses into sustainable fuels and other valuable products—using just the energy from the Sun. It can convert two waste streams into two chemical products at the same time—the first time this has been achieved in a solar-powered reactor. The reactor converts the carbon dioxide and plastics into different products which can be utilised in a variety of industries. Researchers were able to convert carbon dioxide into syngas, a key building block for sustainable liquid fuels, and plastic bottles were converted into glycolic acid, which is widely used in the cosmetics industry. They also designed different catalysts, which were integrated into the light absorber. Changing the catalyst enabled researchers to then change the end product.

Researchers have developed a system that can transform plastic waste and greenhouse gases into sustainable fuels and other valuable products—using just the energy from the Sun (Credit: University of Cambridge)

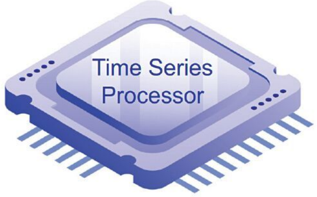
TRULY INNOVATIVE ELECTRONICS

INNOVATION UPDATES

Amongst numerous press releases of new products received by us, these are the ones we found worthy of the title *Truly Innovative Electronics*

Edge time series processor

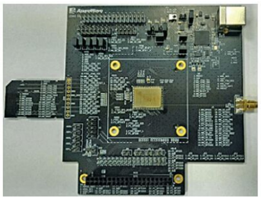
The edge time series processor (TSP) from ABR can process large time series data with lower power. It is based on a new algorithm for AI signal processing called the provably optimal Legendre Memory Unit (LMU) architecture. It can process time series including speech, language, audio, biosignals, RF signals, network traffic, and more at the edge. The TSP is capable of providing 10x to 25x cost advantage over CPU/GPU and 10x to 100x power advantage over existing algorithms computed on CPU/GPU. The edge time series processor SP can enable engineers to design devices that save power and increase response speed, accuracy, and privacy while lowering costs compared to most other existing solutions.



ABR
https://appliedbrainresearch.com

Smallest Wi-Fi HaLow SoC

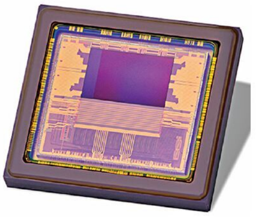
AzureWave Technologies has released the world's smallest Wi-Fi HaLow module powered by Morse Micro MM6108 microchip. The module measures just 13mm × 13mm and can deliver a 10x higher range compared to traditional Wi-Fi solutions. It runs on lower energy and can deliver faster data than the existing solutions. This module can enable engineers to design smaller and energy-efficient IoT products. It can shorten the development process and time to market while providing a transmission range of up to 1km, which makes it suitable for use in IoT applications in large warehouses, smart buildings, smart farms, etc.



AzureWave Technologies
https://www.azurewave.com

Low-light 3D image sensor

Hydra3D + is a Time-of-Flight (ToF) based CMOS image sensor from Teledyne e2v. The image sensor is capable of detecting and capturing 3D images in all light conditions. It offers a 832 × 600 pixel resolution and features a brand-new 10μm three-tap pixel, which provides very fast transfer times (starting from 10ns). The sensor can take images in extremely low light and without motion artefacts, making it suitable for pick and place, logistics, factory automation, factory safety, etc.



Teledyne e2v
https://imaging.teledyne-e2v.com

Wireless charger for multiple devices

AirFuel RF released by AirFuel Alliance is a new global interoperable standard for RF wireless power transfer. It uses radio waves to transfer energy wirelessly and can charge devices up to a few metres. The AirFuel RF can enable wireless charging and powering multiple devices simultaneously within a three-dimensional area. Moreover, this RF technology can be embedded into very small electronic devices, such as electronic shelf labels, wearables, hearable, IoT sensors, etc. It can enable engineers to eliminate battery and design a truly wireless electronics, thus making the device more compact, lighter, sturdier, and cheaper.

AirFuel
https://airfuel.org

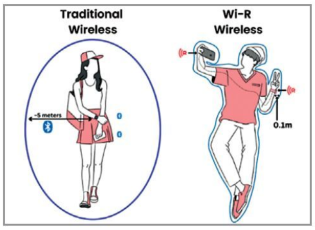
Bluetooth sensor with energy harvesting

SMK's Gen 2 SCPS is a Bluetooth based ambient sensor with energy harvesting capabilities. The Gen 2 SCPS sensor can collect ambient information such as temperature, humidity, luminance, carbon-dioxide, air pressure, accelerometer value, and ambient sound. The energy harvesting capability of Gen 2 SCPS sensor can allow for a battery-free operation of low-powered electronics. The energy harvesting capability and multi-sensing capability in a single package will enable the engineers to develop a light weight, compact, and no maintenance sensor node or other IoT devices that can communicate using Bluetooth.

SMK
https://www.smkusa.com

Low-powered Wi-R solution

The Ixana YR11 chip is equipped with a new Wi-R protocol which consumes up to 100x lower energy compared to Bluetooth or existing Wi-Fi solutions. The solution employs a non-radiative wireless signal that has a range of 2-5 metres in a conductor while less than 10cm around the conductor. This technology utilises a human body as a conductor and confines the signal around the user's body. It can allow engineers to design devices that provide robustness, efficiency, and touch selectivity of the signal. Moreover, it enhances the safety of the system by having a short transmission range from the body and featuring mathematical security that comes from encryption.



Ixana
https://ixana.ai

Low-light image sensor

Compact Mira050 by ams OSRAM is a 0.5-megapixel CMOS image sensor suitable for wearable and mobile devices. It offers high sensitivity to light in the visible and NIR spectrum, thus requiring less illumination to help extend runtime of a battery powered device. The CMOS sensor can enable engineers to build compact wearable devices, and offer power savings at high-quantum efficiency for smart glasses, VR headsets, etc. The Mira050 is suitable for applications such as eye tracking, gesture tracking, and contextual awareness in AR/VR/MR headsets, object detection in robots, and 3D depth sensing for face recognition in smart door locks.

ams OSRAM
https://ams-osram.com

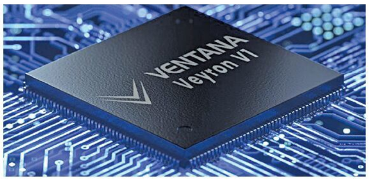
Energy harvesting standalone beacon

BlueRange has released a new beacon with energy harvesting capability. The new beacons combine photovoltaics and Bluetooth beacons to offer a battery-free, standalone system. The beacon is capable of harvesting a light irradiation of 200 lux to power a device and send its sensor data. The beacon can be integrated with sensors to sense various parameters such as carbon-dioxide, temperature, air pressure, humidity, etc and transmit data to a controller or node. The BlueRange beacons automatically form a mesh connection as soon as they are defined as the same network. The mesh is self-organising and self-healing through the best possible connections between devices.

Bluerange
https://www.bluerange.io

High-performance RISC-V processor

Ventana's Veyron V1 is the highest-performance RISC-V processor for data centres running at 3.6GHz in 5nm. It is also the first RISC-V processor to provide single thread performance that is competitive with the latest incumbent processors for data centres, automotive, 5G, AI, and client applications. The



Veyron V1's efficient microarchitecture enables the highest single socket performance, which when combined with RISC-V's open and extensible architecture enables customer innovation and workload optimisation. This results in further workload efficiency gains through domain-specific acceleration that extends Moore's Law to deal with the emerging energy and thermal constraints for data centres.

Ventana
https://www.ventanamicro.com

Low-power, compact, accurate GNSS IC

Synaptics SYN4778 is one of the lowest power, compact, and highly accurate global navigation satellite system (GNSS) IC for IoT devices. The SYN4778 offers up to 80% reduction in power consumption while having up to 50% higher accuracy in a 30% smaller package when compared to most other GNSS ICs available today. The small size of GNSS IC enables designers to employ highly accurate location based services (LBS) for smaller IoT devices such as wearables and asset trackers. When compared to most existing solutions the SYN4778 will enable designers to build LBS equipment with higher battery life, while also having a smaller product size and enhanced performance. It is suitable for IoT devices such as wearables as well as mobile accessories, asset tagging and tracking systems, drones, transportation navigation, etc.

synaptics
LOWEST POWER
SMALLEST SIZE
HIGHEST ACCURACY
GNSS
SYN4778

Synaptics
https://www.synaptics.com

Silicon photonics optical gyroscope

ANELLO Photonics SIPHOG is the world's first silicon photonics optical gyroscope. The SIPHOG is a low-noise and low-drift optical gyroscope smart sensor leveraging a photonic IC technology. This makes it the smallest optical gyroscope in the world, which enables reliable and accurate navigation and positioning across many autonomous applications. The SIPHOG can enable companies to design stable, accurate, and robust sensors for various autonomous applications. It features Anello's Sensor Fusion Engine, which delivers a full end-to-end offering to customers in various fields of autonomy where position, navigation, and timing are essential.

ANELLO
SIPHOG

ANELLO Photonics
https://www.anellophotonics.com

NEW PRODUCTS

MAKE IN INDIA

COMPONENTS

IoT chipset for displays

Genio 700 from MediaTek is a 6nm IoT chipset for smart home and automation applications. It is powered by a couple of ARM A78 cores running at a frequency of 2.2GHz combined with six ARM A55 cores running at 2.0GHz. The combined processing power enables Genio 700 to deliver a capability of 4.0 TOPS AI accelerator. The chipset offers support for FHD60 + 4K60 display as well as an ISP for better images. It is capable of supporting two displays simultaneously. The chipset can enable designers to customise products using Yocto Linux, Ubuntu, and Android.

MediaTek
Genio 700

MediaTek

https://www.mediatek.com

Planar silicon carbide MOSFET

NTH4L028N170M1 is a 1,700V M1 planar EliteSiC MOSFET from onsemi. It is a high-efficiency silicon carbide (SiC) MOSFET rated for 1,700V. The NTH4L028N170M1 offers reliable, high-efficiency performance for energy infrastructure and industrial drive applications. It is optimised for fast-switching applications. The planar technology works reliably with negative gate voltage drive and turns off spikes on the gate. The MOSFET comes in a TO247-4LD package for low common source inductance. It has a low drain-source resistance RDS(ON) of 28mohm and offers low EON and EOFF losses. This MOSFET delivers optimum performance when driven with a 20V gate drive but also works well with an 18V gate drive.

onsemi
NTH4L028N170M1

onsemi

https://www.onsemi.com

SoC for automotive lights

iND83080 from indie Semiconductor is a system-on-chip (SoC) for external automotive lighting. The iND83080 is a highly integrated LED matrix controller that simplifies the design and reduces the cost of advanced, high-definition exterior lighting applications where individual LEDs are turned on and off to deliver pixel-level control. The on-chip integration of a high-accuracy, high-speed clock simplifies system design, enables multi-chip synchronisation, and removes the need for external clock generation, thereby reducing component count. The iND83080 matrix controller SoC is specifically designed for ADB, dynamic turn signal, and dynamic positioning lighting applications.

indie Semiconductor

https://www.indiesemi.com

Low-voltage mini switches

Littlefuse Nano2 fuse switches are one of the world's smallest tactile switches. These miniature, low-voltage fuse switches are designed for use in circuits with a voltage rating of up to 250V AC or 60V DC. They are available in a variety of sizes, from 2.5mm × 2.5mm to 5mm × mm, and are designed to protect circuits from overcurrent and short-circuit conditions. The switches have a compact size and a high interrupting rating, making them suitable for use in a wide range of applications, including consumer electronics, automotive systems, and industrial control systems. These fuses are designed to meet the demands of high-density circuit boards and are compatible with standard surface mount assembly processes. The Nano2 fuse switches are suitable for use in smart wearables, health monitoring devices, and other battery-powered IoT devices.

Littlefuse

https://www.littelfuse.com

Intelligent anti-fog floodlight

BINAY I-FOGSENSE is an intelligent anti-fog floodlight whose PowerLED fixtures can automatically sense and adjust the colour temperature and intensity of the light based on the fog. This PowerLED light uses reliable high-efficacy LEDs which offer system efficacies of up to 165 to 180 lm/watt. The intelligent foglight can offer an energy efficiency of more than 70% over conventional lighting when the LEDs are coupled with energy-saving controls. It employs PLCDC Nanogrid technology that greatly reduces the risk of fire as it works at 48V, which has lower sparking potential

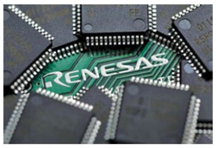
BINAY

https://www.binayled.com

Intelligent automotive power device

The RAJ2810024H12HPD automotive intelligent power device (IPD) from Renesas is a single-channel high side IPD.

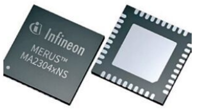
It can safely and flexibly control power distribution within vehicles, addressing the requirements of next-generation electrical/electronic architectures. This IPD features an accurate current detection capability at low loads. It is available in the small TO-252-7 package and reduces the mounting area by about 40% compared to the conventional TO-263 package product. Renesas IPDs have a longer life and are maintenance-free when compared to mechanical relays, which makes them suitable for placing anywhere in the vehicle.



Renesas
https://www.renesas.com

Multilevel Class D audio amplifier

Infineon's MERUS is a multilevel Class D audio amplifier that enables high-fidelity sound playback with a unique Class D modulation of up to 5 different output voltage levels. It can drive up to 2 × 37W at full power, while supporting inductorless low EMI outputs. MERUS multilevel switching technology can enhance audio sounds while consuming only one-tenth of the idle power of traditional Class D amplifiers. Infineon's Class D amplifier can help designers make compact products and lower system costs by removing big, bulky inductors and shielding, and by lowering battery capacity for the same playback hours, thus enabling a faster time-to-market.



Infineon
https://www.infineon.com

Haptic trackpad for laptops

Peratech and Innovobot have jointly developed FusionPad, a haptic force-enhanced trackpad that can enhance the laptop user experience. The touchpad also offers a broad range of functionality, such as muti-finger touch support and fast, accurate haptic feedback to optimise control. It can also eliminate false touch while typing. The FusionPad can differentiate between a finger and a pen with no inconsistencies. All these features can improve typing and navigation of laptops using touchpads better. FusionPad has a thin profile that requires a small space and hence allows for a bigger battery and greater airflow to cool processors and improve overall performance. It is integration-ready and compatible with existing product engineering tools. It is also process and technology ready for AVL-approved supply chains.

Peratech, https://www.peratech.com
Innovobot, https://www.innovobot.com

Multi-function power management IC

nPM1300 from Nordic Semiconductor is a multi-function power management IC (PMIC) with unique system management features. The nPM1300 features Bluetooth Low Energy and offers support for charging of larger batteries and four regulated power rails, thus enabling longer run times and efficient battery charging. It comes in two compact sizes measuring 3.1mm × 2.4mm WL-CSP or 5mm × 5mm QFN. The PMIC is digitally configurable through an I2C interface. The digital interface also provides access to several system management functions, such as hard reset, battery fuel gauge, system-level watchdog, and power loss warning.

Nordic Semiconductor
https://www.nordicsemi.com

Rugged rotary potentiometers

CUI Devices has released a PT and PTN family of rotary potentiometers. The new potentiometers are available in both the shaft and shaftless options. The rotary potentiometers feature resistance ratings from 1 to 2000kΩ and panel-mount or through-hole mounting styles. The potentiometers, ideal for electronic circuits and audio control applications, are rated for a rotational life of 10,000 cycles. They offer linear, logarithmic, or reverse logarithmic tapers, several shaft or rotor styles, and a variety of terminal configurations. The potentiometers are suitable for a wide range of operating temperature from -10 to 70°C. The rugged potentiometers can work at mechanical angles of 235, 265, or 280 degrees, and power ratings of 0.05, 0.15, or 0.20W.

CUI Devices
https://www.cuidevices.com

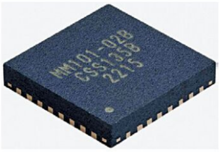
HV driver for MEMS devices

MM101 from Menlo Micro is an 8-channel, low-voltage to high-voltage

WE LOVE TO SHOWCASE NEW PRODUCTS!

Launched a New Product related to electronics?
Share its details with us at newproduct@efy.in
Send a photo too. We will be happy to review it, and if it matches our guidelines—we will publish it here, for FREE!

driver with an integrated charge pump. The MM101 driver provides a cost-effective solution for microelectromechanical system (MEMS) devices and other high-voltage driving applications. The highly integrated voltage divider provides up to eight drive outputs, programmable from 80 or 90V, in a miniature 5mm × 5mm 32-pin QFN or WLCSP flip-chip package powered with 5V charge pump and 3.3V driver circuit supply sources. It offers various protection features, including interface fault indicators, power-on-reset, power on/off sequence control, and undervoltage protection for charge pump and supply voltage. The MM101 driver provides a compact, power-efficient solution for driving the MEMS based switches, thus bringing size, weight, power, and cost benefits to a wide range of applications.



Menlo Micro
https://menlomicro.com

BOARDS AND MODULES

High-density AC-DC power supplies

The SL Power NGB800 800 W and NGB1200 1200 W from Advanced Energy are AC-DC power supplies for medical and industrial power conversion platforms. The power supplies offer one of the highest power densities in the industry and a high efficiency of up to 90%. The supplies come with medical and industrial safety and EMC approvals and are suitable for operating at a wide input range of 85 to 264V AC and provide output voltages from 12 to 48V DC. Both the power supplies are convection cooled, which makes them suitable for ventilated spaces, while the 1200W NGB1200 power supply also features a low-noise fan that makes it more reliable for power-intensive applications. The power supplies are optimised for addressing performance and reliability in a small form factor, making them suitable for power-intensive systems capable of meeting high requirements of industrial and medical applications.

Advanced Energy
www.advancedenergy.com

Regulated DC/DC converters

RXM series is a family of surface-mount, cost-effective, regulated DC/DC converters from RECOM Power. The RXM series includes R5M, R3M, R2M, and R1M, rated at 5W, 3W, 2W, and 1W, respectively. All the modules feature a common case size of 13.2mm × 9.1mm footprint, 10.2mm height, with the R2M additionally available in a through-hole DIP8 package. The RXM series operates over a 4:1 input range of 9-36V DC or optionally 18-75V DC, while the R3M, R2M, and R1M range additionally include 4.5-18V input. The modules offer an isolation rating of 1.6kV/1min. The RXM series offers various safety features, including no minimum load operation, continuous short-circuit protection, and an on/off control pin. The DC/DC converters have an efficiency of up to 84% and come with an advanced circuit and thermal design results.

RXM series
10.2 mm
9.1 mm
14.2 mm

RECOM Power
www.recom-power.com

Network storage interface card

iWave's SmartNIC storage accelerator card is an FPGA based network interface card that can enhance the server's compute capacity. The SmarNIC can help offload the tasks from the host server's CPU and accelerate the workload. This can enhance the connectivity and communication between a computer and a network, which can further increase the data and signal processing capability of the server. The SmartNIC features dual front panel QSFP DD Cages-2x 200GbE/4x 100Gbe Ethernet and high-performance storage extension with triple NVMe slots. The module also offers The 3/4 Length PCIe Gen3 x16 host interface on the board that connects the SmartNIC to the computer/server. This NIC card can help leverage the internet speeds offered by the service provider and offers multiple advantages, including better security functions that can protect the CPU from malicious attacks.

iWave
https://www.iwavesystems.com

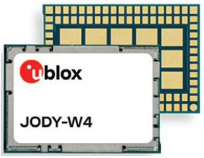
SoM for ML edge devices

VAR-SOM-MX93 from Variscite is a system-on-module (SoM) for energy-efficient machine learning (ML) edge devices. The VAR-SOM-MX93 is designed to accelerate ML and offers an energy-flex architecture for efficient processing. It features a 1.7GHz Dual Cortex-A55 NXP iMX93 processor and an additional 250MHz Cortex-M33 real-time co-processor with a dedicated Neural Processing Unit (NPU) 0.5 TOPS and built-in security features. The SoM offers industrial features like 2x CAN bus, 2x GbE, and industrial temperature grade plus a wide range of features and connectivity options, such as camera inputs, audio in/out, ADC, 2x USB, certified dual-band Wi-Fi, BT/BLE, and display outputs. The VAR-SOM-MX93 is included in Variscite's long-term longevity plan and will provide an expected availability of 15 years. This SoM can enhance energy efficiency of the products and offer designers reduced development time, costs, and risks.

Variscite
https://www.variscite.com

Automotive module with multi-connectivity

JODY-W4 from u-Blox is the first automotive-grade module supporting Wi-Fi 6E technology and Bluetooth LE Audio functionalities. The module features three antenna ports and comes in a compact size measuring just 13.8mm × 19.8mm × 2.5mm. The JODY-W4 works at a frequency of 6GHz in addition to 2.4GHz and 5GHz, which allows it to use additional high bandwidth channels, thus enabling the support of current and future connectivity needs. This module features the latest Bluetooth Low Energy 5.3 version, which improves the audio experience, enables long-range support as well as compatibility with new accessories. It may also operate as a Wi-Fi DFS master with zero-wait, an advantageous function within areas like airports where the use of certain channels is restricted. This ready-to-go solution is ideal for addressing multiple interface, cost, and complex design challenges.



u-Blox

https://www.u-blox.com

30W isolated DC-DC converter

THL30WI from Traco Power is a 30W isolated DC-DC converter designed for easy integration into mobile equipment, instrumentation, and distributed power applications. The DC-DC converter comes in a metal package measuring 2.5cm × 2.5cm × 1.0cm with a through-hole pinout for easy soldering into a range of applications. The module has high efficiency of up to 88% and offers integrated remote on/off and trim functions. It can operate at a wide range of temperature from –40°C to +60°C without derating. The module has a wide 4:1 input voltage range and precisely regulated, isolated outputs. The series meets the latest IT safety certifications (UL 62368-1) and is suitable for use in mobile equipment, instrumentation, distributed power architectures in communication and industrial electronics, and in applications where cost-efficiency and quality are critical factors

TRACO POWER
THL 30-2411WI

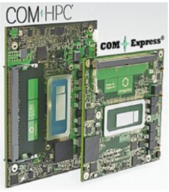
Traco Power

https://www.tracopower.com

EMBEDDED

13th Gen Intel core CoMs

The new computer-on-modules (CoM) from Congatec employ a 13th Gen Intel core processor which enables them to deliver higher performance and data throughput. The COM-HPC and COM Express CoM can deliver up to 8% higher performance from a single thread and up to 5% in the multi-thread configuration when compared to a 12th Gen Intel Core processor. The new modules can enable designers to ramp up quickly and massively as the new processors with long-life availability offer vast improvements in many features, yet are fully hardware compatible with the predecessors, which makes implementation very fast and easy. All these features offer significant improvement in a wide range of compute-intensive applications, including embedded and edge computing with workload consolidation. Both the modules are suitable for use in a wide range of industrial, medical, and artificial intelligence applications.



Congatec

https://www.congatec.com

Universal embedded system housings

Pheonix's UCS series of housings offers an adjustable and universal solution to accommodate PCBs or single board computers. The IP40 housings can reliably protect PCBs in a standard form factor and custom designed PCBs from external influences. They can reduce the required space and can be easily mounted on DIN rail or wall. Moreover, the housing can also be used as a desktop with the help of a few accessories, thus offering flexibility in the mounting style. The company offers various versions, including one with a flexible PCB attachment or with a fixed PCB attachment, which is integrated into the corner dome. The removable side panels enable modular electronic solution, which can be cut according to the requirement of connection to be used. There is a stronger version made of aluminium for higher strength, suitable for harsh industrial environments.

Pheonix Contact

https://www.phoenixcontact.com

Low-cost 32-bit microcontrollers

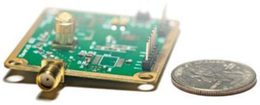
STM32C0 from ST is a 32-bit microcontroller (MCU) series for cost-sensitive applications. The STM32C0 series is suitable for use in equipment like home appliances, industrial pumps, fans, smoke detectors, typically served by simpler 8-bit and 16-bit MCUs. The modern, 32-bit design of the STM32C0 permits improvements, such as faster response, extra functions, and network connection at similar overall cost and power consumption. The STM32C0 family is simple to use and offers free and extensive support ecosystem with resources like tools, software packs, and the chance to connect with various developer communities to ease entry to the 32-bit world for new users.

STMicroelectronics

https://www.st.com

Amateur radio receiver module

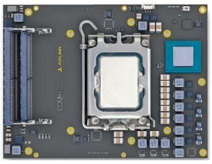
MAVERICK-603 is the first commercially available RF device with an open source chip. It is an easy to use, amateur radio receiver powered by an ATmega 1608 microcontroller (MCU). The module comes in a small size measuring 5cm × 4.4cm and has an operating frequency range of 1 to 100MHz and a minimum signal strength of -25dBm. The use of low noise amplifier (LNA) in the module gives the chip an ability to amplify very low-strength signals, thus reducing the need for any additional external hardware. Since the FT8 is a digital weak signal communication used primarily by amateurs, the radio operators need no amateur radio license to receive FT8. For data transfer the module uses SPI and UART data interface.



Radio Stack
https://www.radiostack.com

CoM for on-device AI

ADLINK Technology has released COM-HPC-cRLS based on the Intel 13th Gen Core processors. The Client Type COM-HPC Size C module is based on Intel's 13th Gen Core desktop processors. It combines power efficiency with performance and fulfills various demanding AI, graphics, and mission critical IoT applications. The ADLINK COM-HPC-cRLS offers up to 24 cores and 32 threads to deliver superior multi-thread and multitasking performance. It harnesses up to 128GB DDR5 SODIMM and two 2.5GbE LAN. The computer-on-module (CoM) is built for the instantaneous on-device AI applications. The COM-HPC-cRLS is suitable for applications including industrial automation, autonomous mobile robot, autonomous driving, medical imaging, entertainment, and video broadcasting.



ADLINK Technology
https://www.adlinktech.com

TEST & MEASUREMENT

Performance vector tester

R&S PVT360A is a VSG/VSA single-box performance vector tester from Rohde & Schwarz. The tester is suitable for high-speed, high-throughput testing of all forms of 5G FR1 base stations and small cells as well as for RF components characterisation or production. The PVT360A has an operational frequency range from 400MHz to 8GHz that covers all 5G FR1 requirements. The optional second generator and analyser support multiport component tests, true MIMO testing, or simply double the test capacity. The PVT 360A is capable of fulling the demanding requirements of the test environment such as minimum error vector magnitude (EVM) in test signals and high test throughput. The low EVM of the R&S PVT360A signal generator provides high precision test signals for minimal measurement uncertainty.

Rohde & Schwarz
https://www.rohde-schwarz.com

MISCELLANEOUS

Halogen-free solder paste

Indium Corporation's SiPaste C201HF is released for fine feature printing with a halogen-free, cleanable solder paste. The solder paste combines a non-wet open (NWO) performance with excellent stencil print transfer efficiency that can satisfy a broad range of process requirements and boost SPI yields. Moreover, the SiPaste C201HF leaves behind a cleanable residue, which can easily be removed with a commercially available semi-aqueous cleaning solution, or it can be used as a standard no-clean paste in processes where post-reflow cleaning is not applicable. It offers consistent and tight solder deposit spread across multiple prints along with excellent response-to-pause performance. It offers minimal voiding on tight-pitch components, ensuring joint strength on small components and an excellent reflow performance on components that exhibit high warpage.

SiPaste
C201HF

Indium Corporation
https://www.indium.com

Software for safer autonomous vehicles

FusionEngine software from Point One Navigation is a high-performance ASIL-rated precise location solution for automotive applications. The software is compatible with ST's Teseo-APP (Teseo ASIL Precise Positioning) GNSS chipset. The combined solution assures functional safety at ASIL-B, a critical requirement for Level 3 + ADAS systems. FusionEngine can be easily integrated into a variety of host processors that are used for enabling Level 3 + ADAS and autonomous driving systems. FusionEngine combines data from multiple sensors to assure the high accuracy, safety, and integrity required for higher levels of autonomous vehicles. Point One's FusionEngine enables developers to complete the Functional Safety Concept Phase for their host system software integration. This includes the definition of Safety Goals, Functional Safety Requirements (FSR), and Technical Safety Requirements (TSR) as well as the test methods to provide evidence of successful integration.

Point One Navigation
https://pointonenav.com

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"The IoT MARKET Has The POTENTIAL For 50-60 BILLION UNITS A Year In The Next Decade"

MATT JOHNSON
PRESIDENT AND CEO,
SILICON LABS

Silicon Labs has been expanding its footprint in India since the last couple of years. They recently announced a new (and a bigger) office for their India team. What's driving this change in strategy? What are the plans for the future? Rahul Chopra, Editor, spoke to Matt Johnson, President and CEO, Silicon Labs and Manish Kothari, SVP and Head of India Center, to find out

How do you define your market? And how's it been the last couple of years for you and your team?

Matt: We focus exclusively on the IoT wireless space, and it's fascinating for us that this space is growing at a pace we have never seen before. Our market has the potential for growing to 50-60 billion units a year in the next decade, which is incredible. We have never seen anything like that in the semiconductor space. We are the largest company in the world that is dedicated to IoT wireless. We are making good progress. We have doubled the size of the company in the past two years, but we are even more excited about the future. We are in the middle of a really strong product cycle in an industry that is gaining momentum.

How do you define Silicon Labs?

Matt: We provide all the requisite low-power wireless technologies for IoT and what they will become in the future. Our solutions comprise a wireless SoC, which includes all the requisite components that someone would need, including computing, security, and all the peripherals. In some cases, ours is the only IC in the design because it is a complete system solution. We also provide the complete software support that goes with it, including all the tools for the developers, and all the services and support as well.

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What is your vision for Silicon Labs?

Matt: Our position and momentum is to become what Intel and Qualcomm were for their respective spaces, and we truly have that opportunity. Over a year ago, we divested everything unrelated to our IoT focus, because we saw our market taking off for the next decade and beyond. We wanted to ensure we did not miss the opportunity to be two or three times larger than any other competitor in the space.

Is Wi-SUN a good bet for smart city applications? What about cellular or other wireless options?

Matt: It is a tough space for customers to navigate. Cellular is a good option for some classes of applications, but it is also expensive and power-hungry. There is also LoRaWAN as an option. The challenge with LoRaWAN is that it is a closed standard, with licensing fees for users. This limits the scalability of LoRaWAN and is part of the reason I said no to this space for a long time as there was nothing open.

So, there is a big gap out there for electrical distribution, metering, etc kind of applications, where you may need many nodes which can operate in a mesh network or framework and work through each other and have a super-long battery life, sometimes up to 10 years. That implies years of operating openly, with industry-leading security. That is a unique combination of features which were not supported by any device, till now.

At the risk of sounding biased, I believe we have cracked it. Our chipset, FG25, supports Wi-SUN and is currently being sampled in our Alpha program. We have more interested customers than we have slots in the program, and they are waiting for their turn to move into it. This shows the demand for, and interest, in this space. The Wi-SUN momentum over the last two or three years has accelerated and not slowed down at all. So, when you step back and say, well, what happened? Why isn't 5G moving faster? I think it will, as we said, but this type of solution hits a sweet spot in the market where major growth is occurring. There was nothing that truly served this and hit all those checkboxes, but this one does.

How do you see the evolution of 5G? Is that a potential threat or do you consider it an enabler?

Matt: We consider it an enabler and an important component of IoT. To understand it, let us pick smartphones or the handset space, which were born and rely on cellular, but they also support multiple other wireless technologies, such as Wi-Fi, Bluetooth, and others. The IoT will be no different. We're capable of doing and providing a solution that can support wireless, up to three kilometers, and can operate on a watch battery or coin cell battery for 10 years. Some of these applications need hundreds of thousands of end nodes. Cellular battery life is measured in days or maybe weeks, and we are talking about a battery that could run for about a year.

There is a whole set of devices that sit on the true edge that would never be possible without this type of cost and power battery life that we can bring. Cellular can connect a lot of little devices to a longer-range network. It's a very symbiotic relationship and has moved a lot slower in 5G and IoT than people thought or expected. Low-power wireless technologies, such as Thread, ZigBee, Z-Wave, Wi-Fi, and Bluetooth, have just exploded in the IoT space, but we have been able to double our size over the last couple of years because our adoption strategy was strong. I do expect 5G to play a bigger role over time, but it won't be a majority role for sure. It would be very complimentary.

Why should CTOs be well-versed with Amazon Sidewalk? Why is it important, and for what use cases?

Matt: Amazon Sidewalk creates shared wireless networks connecting IoT devices at home and beyond the front door, across the entire neighborhood, and even the city. By providing the most complete, reliable, and one-stop-shop wireless development solution for Amazon Sidewalk, we want to simplify the process for developers, reduce costs, and accelerate time to revenue for Amazon Sidewalk IoT devices. In addition to extending connectivity beyond the front door, Amazon Sidewalk can be used by IoT applications to deliver end-users convenience while opening up new possibilities for device manufacturers.

Manish: Amazon Sidewalk can use three different PHYs at the radio layer to address the different networking use cases:

1. Bluetooth Low Energy radio PHY can be used for Amazon Sidewalk applications in or near the home with short-range connectivity for devices such as environmental sensors and connect a device to a smartphone with Amazon Sidewalk coverage.

2. GFSK radio PHY can cover up to one-acre lot and can address applications that need to cover detached buildings and yards such as pool, spa, and water mitigation. GFSK can even support smart city and neighborhood applications with Amazon Sidewalk coverage.

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trum) radio PHY can reach several miles to support applications where devices are far from the nearest gateway—these can include smart neighborhoods, universities, and agriculture with Amazon Sidewalk coverage.

Can you explain what's Matter? And the role Silicon Labs has played in its rise to prominence?

Matt: Matter, formerly named project Connected Home over IP, or project CHIP, is designed to provide interoperable, reliable, secure connectivity across IoT devices and networks. Matter simplifies both product development and the end-user experience by providing a unified connectivity standard for a wide range of smart home and commercial applications, including LED bulbs, door locks, HVAC, commercial lighting, and access control.

In May 2021, Silicon Labs announced that wireless solutions are available for the development of Matter end products that support Thread, Wi-Fi, and Bluetooth protocols. Silicon Labs Matter solution enhances the connected product experience across major ecosystems, including Amazon Alexa, Apple HomeKit, and Google. By sharing our extensive wireless experience with the Matter community, and providing more than 20% of the source code, we are bringing new opportunities to the future of IoT connectivity. Our wireless solutions for Matter allow developers to focus on innovation and bring products to market that enable a seamless consumer experience.

Manish: We are working towards developing the future of reliable connectivity with Matter. The company has been heavily involved in Matter development with a wide-ranging suit of development tools, software, and wireless solutions available from the Series 1 and 2, including MG12, MG21, WF200, WFM200, and RS9116. That's why the CSA included us in Amsterdam to celebrate the launch of Matter 1.0 in November of last year. As Matt said, it really is bringing the industry together.

Silicon Labs expands in India with a new office in Hyderabad

Any major contribution by the India centre recently?

Matt: One of our recent launches—a Wi-Fi Six and BLE combination, a wireless SoC—that is Matter-ready. Named the Silicon Labs SiWx917, the device has twice the battery life of previous solutions, which is remarkable. That product was developed by the India Team. This is a remarkable transformation and moment for us as a company, as we didn't have a position in India two years ago.

In last September, we announced the opening of our new development centre in Hyderabad. This is a remarkable milestone and moment for us as a company. This credit goes to Manish for what he has done here. He truly led this and walked us to this point where it is not just about the size and scale of this site, it is also about the products that are coming out of here. And we are just beginning this journey. We are excited about that.

Manish: Our Hyderabad office is the largest and fastest growing wireless development centre, and I am proud to say that we have more than 500 engineers, and probably will have more in the coming years. Hence, it's a remarkable journey that we have gone through and contributed to a variety of different areas that Matt just described.

It's very interdisciplinary, like what we do. I will just give you a flavour of the skillsets we employ: computer science, electronics, and

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people with backgrounds in physics, math, and materials. They all come together in hardware engineering and software engineering applications to build this ultra-low-power SoC.

Where does India fit in the overall scheme of things?

Matt: Historically, India has not been a large market for us. As we are moving forward, we see the market developing, and we see opportunity and potential here. We want to capture that and we are starting to make moves and initiatives to better cover and service the market.

Manish: The market is starting to grow. If you look at smart metering, one of the largest companies globally that is a customer for us is in India. It is going to be exciting times ahead as a market as well.

What is your vision for the India centre? What is your goal for Manish and the team?

Matt: Manish and I share the same vision for the site. We want this to be the region's premier, leading wireless technology centre. It is the fastest growing and largest site for us as a company. Our vision for the site is that it is not just a support site or a complementary site. It is a core leading force to be reckoned with in our industry. That is the way we are approaching the office setup, the hiring of the talent, and the leadership. That's our goal and vision for the site.

Any highlights or features of the new office that's been set up by Silicon Labs?

Manish: Hyderabad, rightly termed as the Knowledge City, has been a vibrant centre of technology innovation, including some of the best universities, top global companies in research and manufacturing, and thriving startups. Our Hyderabad office is home to a talented team of hardware, software, and applications engineers. The Hyderabad wireless development centre is instrumental to our innovation and growth. It is going to be a Centre of Excellence for integrated hardware and software platforms, user-friendly development tools, and an unsurpassed ecosystem of new wireless technologies to boost innovation and automation for our customers.

The office houses more than 10,000 square feet (929 square metres) of hardware and software labs and ample breakout spaces for fostering collaboration and innovation. Other amenities include quick access to eateries, socialising venues, and public transport. EFY

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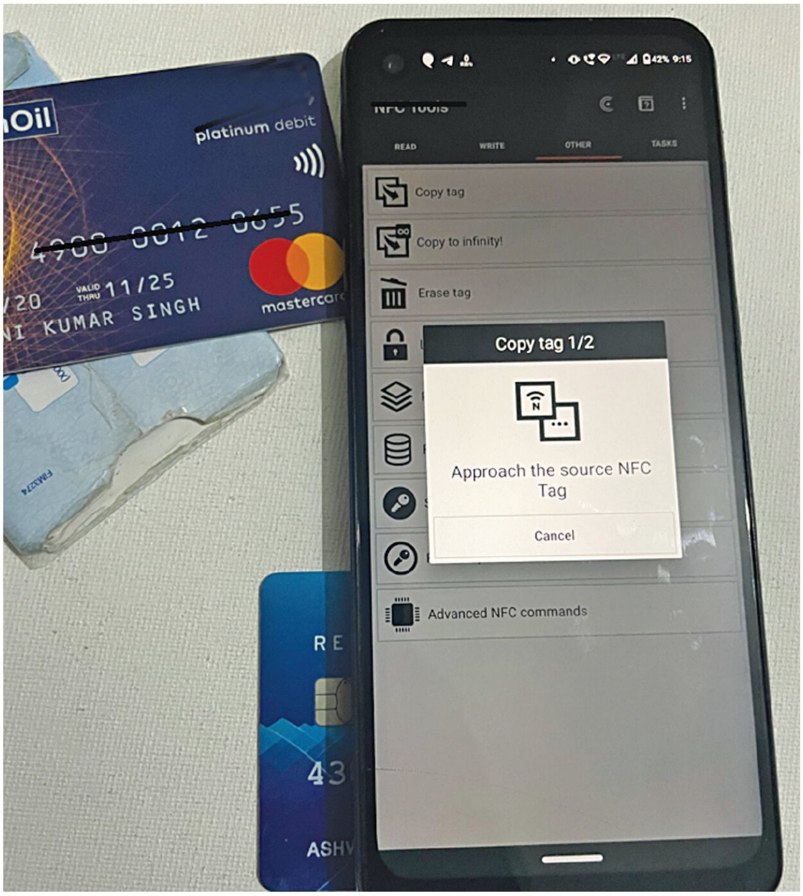
How To PROTECT Against CREDIT And DEBIT CARDS' HACKING

This article is only for readers' awareness and to keep them protected against phishing devices that are being used to copy and misuse credit and debit cards data. The possibility of hacking has increased with the recent use of contactless cards

ASHWINI KUMAR SINHA

NFC, which stands for near field communication, is a short-range wireless technology that allows devices to communicate with each other when they are in close proximity, usually no more than a few centimetres apart. It is a type of RFID (radio frequency identification) technology, but it operates at a much shorter range and at a higher frequency.

NFC is used in a number of applications, including contactless payments, access control, and data transfer. Now even our cars and toll tax barriers use the NFC. The technology is widely used in many devices, including smartwatches and rings, to enable a variety of functions, such as authentication and payments.



Author testing the NFC cloning of card using phone and NFC tool

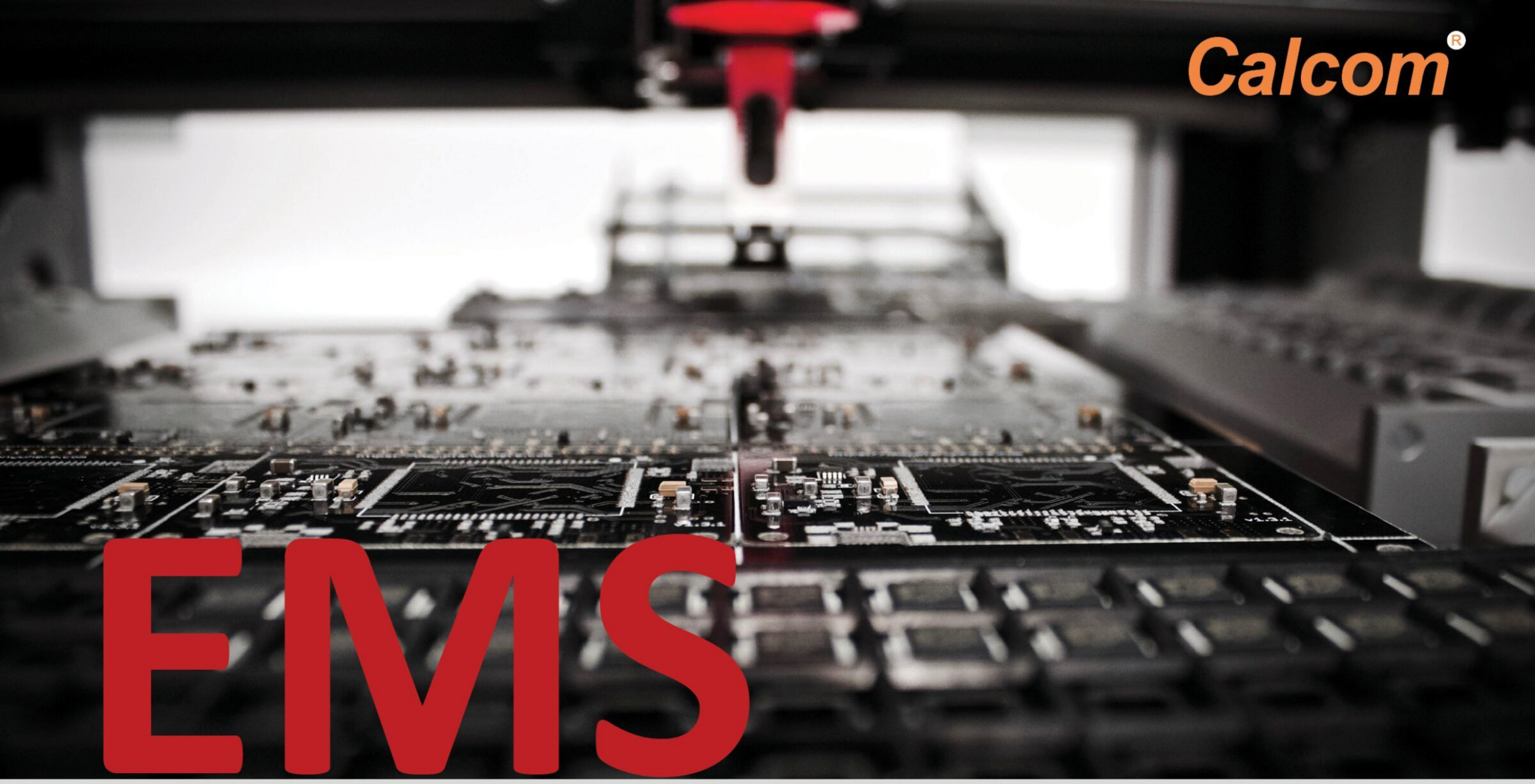
NFC-enabled rings can also be used for authentication and payment purposes. For example, an NFC-enabled ring can be used to unlock a door or make a payment by simply holding it near an NFC reader. These types of devices offer a convenient and secure way to conduct transactions and access secure areas.

Nowadays, passports also use NFC for transmitting data to a system containing sensitive information about you. But the daily involvement and dependency on NFC technology raises a concern whether this technology can be problematic for our security? Before getting deeper into its security threats let's see how this technology works.

How NFC works

NFC uses magnetic field induction to transmit data between two NFC-enabled devices that are physically close to each other. When one device, such as a smartphone, is brought near another NFC-enabled device, an electromagnetic field is generated between the two devices. This field allows the devices to communicate with each other and exchange data. One device has a chip with a coil but no power supply while the other is a reader or writer having an antenna and power supply to transmit the data.

The NFC communication involves three main steps:



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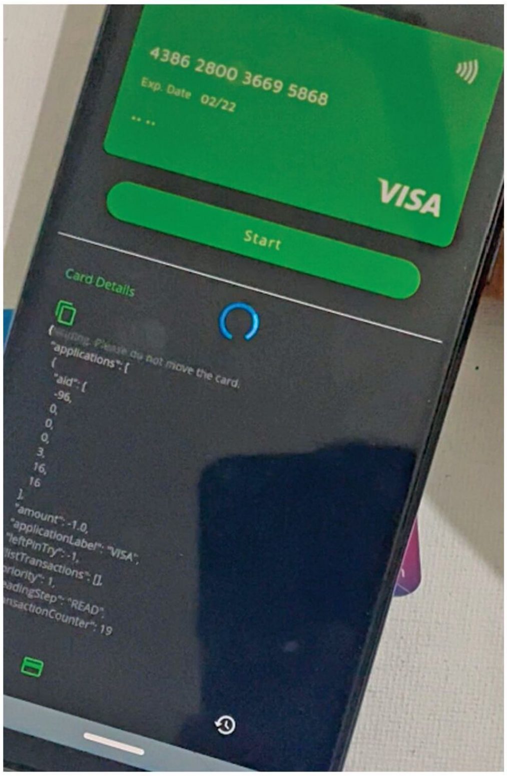

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(waiting. Please do not move the card.
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nsactionCounter": 19
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The author retrieved the credit card information and transition details using NFC on the phone and the NFC tool app

1. Initiating communication. One of the devices, usually the one that initiates the communication, becomes an NFC reader. The other device becomes an NFC tag, which is read by the reader.

2. Establishing a connection. The reader and the tag establish a connection by exchanging a series of signals. The reader sends a request to the tag, and the tag responds by sending back its ID and other information.

3. Transferring data. Once the connection is established, the devices can exchange data. The reader can request specific data from the tag, or the tag can send data to the reader without a request.

How secure NFC debit cards are

NFC is often used in credit and debit cards as a way to enable contactless payments. When you use an NFC-enabled credit or debit card to make a payment, the card communicates with the payment terminal using RF waves. This allows you to make a payment simply by tapping your card on the terminal, without the need to insert it into a card reader and enter a personal identification number (PIN).

NFC is based on the ISO/IEC 14443 standard, which defines the technical requirements for contactless smart cards and the communication between them and the reader. There are different types of NFC technologies that are used in credit and debit cards, including:

Type A. This is the most widely used type of NFC technology in credit and debit cards. It operates at a frequency of 13.56MHz and uses a protocol known as ISO/IEC 14443-3A.

Type B. This type of NFC technology is similar to Type A, but it uses a different protocol known as ISO/IEC 14443-3B. It is less common than Type A, but it is still used in some credit and debit cards.

FeliCa. This is a proprietary NFC technology developed by Sony and used primarily in Japan. It also operates at a frequency of 13.56MHz but uses a protocol known as JIS X 6319-4.

Overall, the type of NFC technology used in a credit or debit card will depend on the specific card and the payment system it is designed to work with. Regardless of the type of NFC technology used, the security measures built into NFC technology and the additional security features of credit and debit cards, such as chip-and-pin or chip-and-signature protection, help to ensure the safety and security of contactless payments.

That being said, no technology is completely foolproof, and there is always a risk that a hacker could find a way to bypass the security measures in place. To help protect yourself from potential NFC-related fraud, it is important to take steps to secure your credit and debit cards, such as keeping them in a safe location, monitoring your accounts for any suspicious activity, and reporting any lost or stolen cards as soon as possible.

Hacking NFC

There are different ways a hacker might attempt to hack NFC, such as:

Skimming. This involves using a reader and writer device to capture the data transmitted between an

User stealing data from a card using phone

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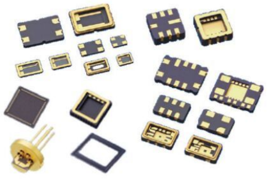

Ceramic Packages

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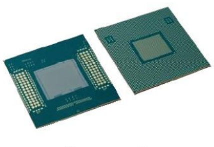

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NFC-enabled credit or debit card and a payment terminal. The data is then used to create a copy of the card. Or hackers can use the high-range NFC reader and writer and pass by you to read the card details and make a copy of your NFC card to make fraudulent purchases.

There are various tools and apps like Flipper using which the hackers can read your card data, store it, and even clone it. The data stored in NFC can also be copied easily by a phone or a reader device. The hackers can then use your card number and other details to use it for fraudulent purchases. In worst cases, hackers can even inject their own code or simply erase your credit card by using NFC writer tools. However, no such complaints have arisen yet.

It is however hard nowadays to do fraudulent transactions using a hacked credit or debit card details as it requires an OTP or PIN while spending beyond a certain amount (generally, ₹5,000). A couple of ways a hacker may copy your card's details are mentioned below.

Man-in-the-middle attack. This involves a hacker intercepting the communication between an NFC-enabled card and a payment terminal, and either altering the data being transmitted or injecting their own data into the communication.

Outer Pocket
Use as normal pocket
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Put your cell phone and car key fob in this
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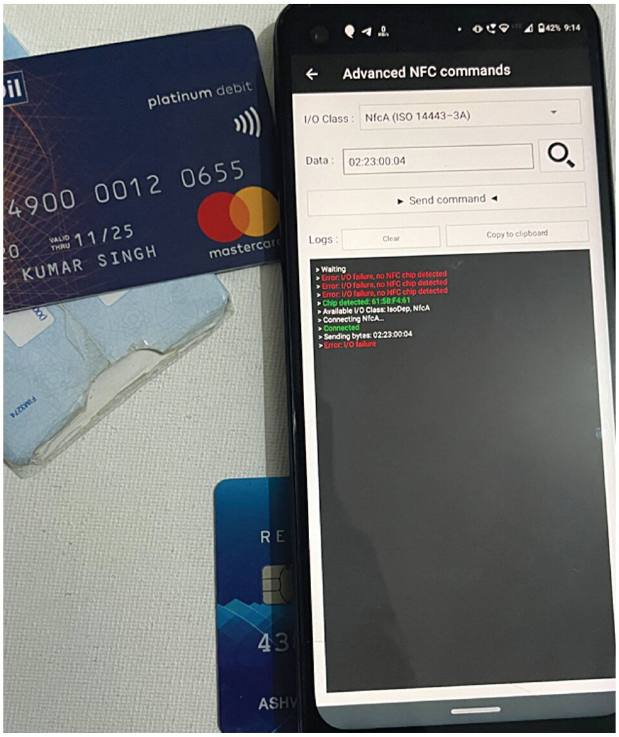
Faraday Bag for credit and NFC cards



I/O Class : NfcA (ISO 14443-3A)

Data : 02:23:00:04

Logs :

```
> Waiting
> Error: I/O failure, no NFC chip detected
> Error: I/O failure, no NFC chip detected
> Error: I/O failure, no NFC chip detected
> Chip detected: 61:58:F4:61
> Available I/O Class: IsoDep, NfcA
> Connecting NfcA...
> Connected
> Sending bytes: 02:23:00:04
> Error: I/O failure
```

The author tests the injection of codes and attempt to change the information inside the NFC of the credit card

Physical tampering. This involves physically modifying an NFC-enabled card or payment terminal in order to bypass security measures or to gain access to sensitive data.

The main feature of NFC is it works only over a very short distance. So, hackers can fetch data from your NFC-enabled card only when they are near the card. It is possible to design an NFC reader with a longer range by using multiple coils.

NFC operates at a high frequency 13.56MHz and requires a close proximity between the two devices in order to establish a connection. Increasing the range of an NFC reader beyond a few centimetres would require the use of a lower frequency, which would result in a slower data transfer rate.

If you analyse the underlying physical equations in the case of a circular loop coil antenna, the near field range (suitable for NFC communications) is about 1.414 times the radius of the circular coil. To achieve a practical 60cm range, you may try to create a near field with a theoretical range several times bigger, for instance, 180-240cm, for which you need a circular coil of about 2.5-3.4 metres in diameter. But you can change the shape and try the square shape for that.

How to protect yourself

The possibility of your debit or credit card being cloned increases tremendously in public places and crowded metro, bus, train, etc, while travelling. Anyone with an NFC reader or phone can get your card data by coming close to your wallet in your pocket or elsewhere.

One of the measures that can be taken to protect yourself is by using the Faraday purse or wallet. These wallets have layers of Faraday cage that block the signal and protect against your cards' data being read or cloned in such crowded places. There are some small metallic enclosures also available, which can be easily kept in a pocket like a wallet, to keep the cards protected.

Setting limit to NFC transactions can also protect you from heavy losses. You can ask your bank or card provider to set transaction limit for contactless payments through your cards. Using, multi-factor authentication or a digital PIN setting for an NFC card is another way to protect yourself from fraud. **EFY**

Ashwini Kumar Sinha is an IoT and AI enthusiast tech journalist at EFY

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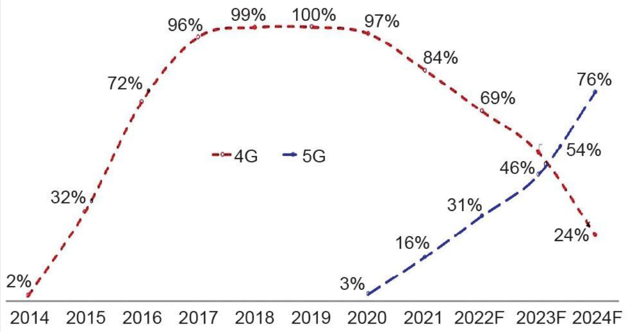
THE DASHBOARD

India'23: 5G Smartphone Shipments to Cross 4G

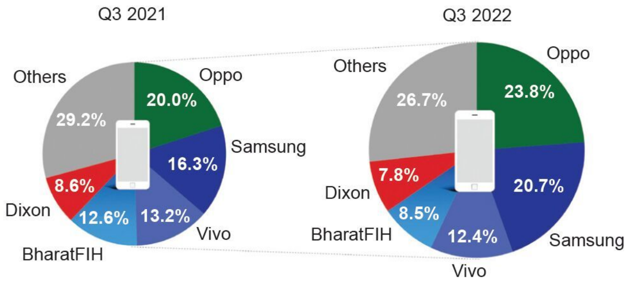
As per the latest report, India's 5G smartphone shipments are expected to grow 81% YoY in 2022 driven by their increasing presence in lower price bands (<₹20,000) and the 5G network rollout. Notably, 5G share in lower price bands (<₹20,000) is progressing gently, from 4% in 2021 to 14% in 2022. The report suggested that the growth has been limited due to component supply shortages, inflation, geopolitical conflicts, and other macroeconomic issues. This has delayed 5G device launches in the budget segment. India's smartphone shipments are projected to witness a yearly decline in 2022 due to macroeconomic factors affecting consumer demand in the entry and budget segments. Notably, the cumulative 5G smartphone shipments will cross the 100-million mark in Q2 2023 and go above the 4G smartphone shipments by year-end.



(Source: Counterpoint Research)

'Made in India' Smartphone Shipments Fall in Q3

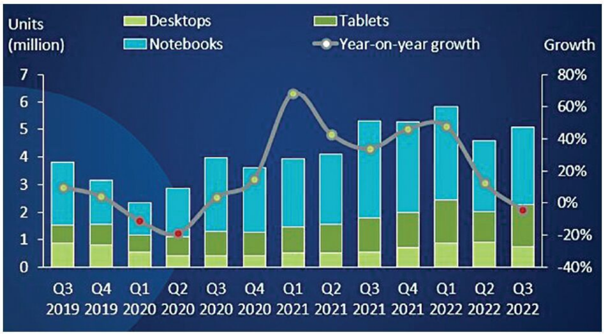
According to recent research, Made-in-India smartphone shipments dropped 8% YoY in the July-September quarter (Q3) of 2022 to reach over 52 million units. Even as the shipments were on an upward trail earlier this year, declining consumer demand and global market uncertainties led to this decline in 3Q22. The report noted that OPPO led these smartphone shipments with a 24% share, followed by Samsung. However, in terms of smartphone shipments, Bharat FIH kept the top spot in the EMS domain. Dixon emerged as the top smartphone EMS provider among the Indian players.



(Source: Counterpoint Research)

Indian PC Market Fell 4% in 3Q22

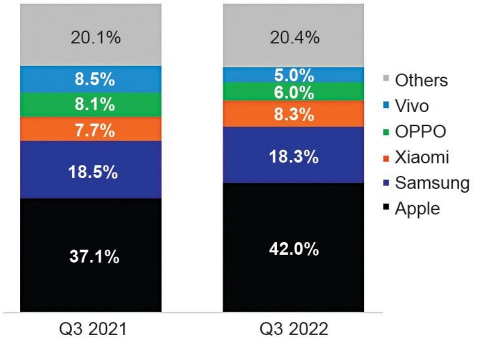
As per the latest findings, the Indian PC market (desktops, notebooks, and tablets) witnessed a 4% YoY fall in Q3 2022. It hits majorly because the market was consecutively growing for the previous eight quarters. The shipments fell to 5.1 million units, and notebook shipments—the largest category by volume—fell by 21%, causing the overall market decline this quarter. This is because the other two categories, desktop and tablet shipments, witnessed major annual growth in Q3. While desktop shipments grew by 36% to 766,000 units, tablet shipments grew by 24% to 1.5 million units.



(Source: https://canalys.com)

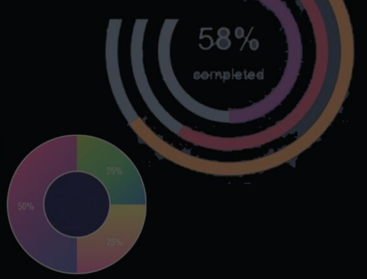
Global Handset Revenues and Shipments Drop in Q3 of 2022

In Q3 2022, the global smartphone handset market's revenue declined 3% YoY to just cross the $100 bn mark. Interestingly, the average selling price (ASP) grew by 10% YoY due to the premium handset segment's greater resilience to economic uncertainty. The record shipment contribution (46%) of 5G handsets, which cost 5x an average non-5G handset, also added to the ASP and revenue growth. In terms of shipments, the overall handset market witnessed a 12% YoY drop in 3Q22. The report pointed out that a steeper revenue fall was prevented by a 10% YoY revenue growth of Apple. And as a result, the 5G revenue share reached an all-time high of 80%.



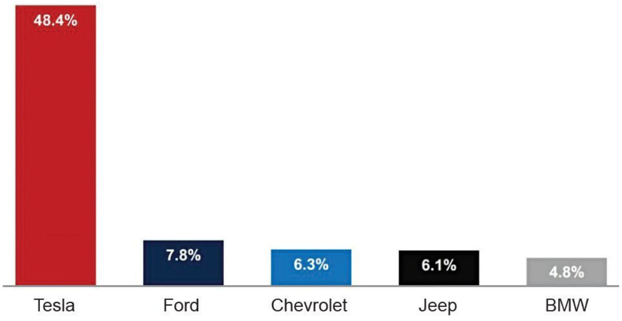
(Source: Counterpoint Research)

At-a-glance view of key industry trends that can shape the future of your business…



US EV Market: 52% YoY Growth in 3Q22; Tesla Tops

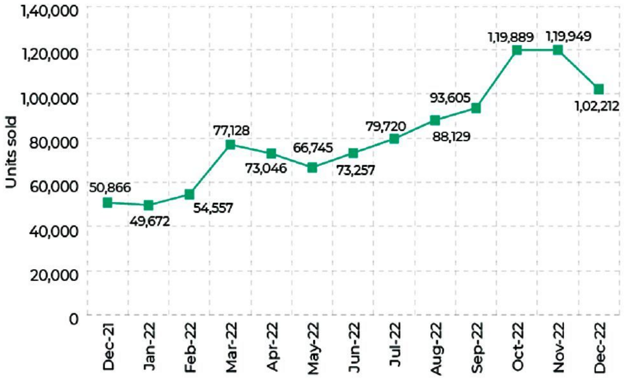
According to a recent report, the US EV (electric vehicle; BEVs and PHEVs only) sales grew by about 52% YoY during the third quarter of 2022. The numbers carry significance given the strong macroeconomic hurdles that were present for a notable time period of the year. The report further specified that the sales of Battery EVs (BEVs) grew by over 78% YoY during this quarter, making them an 80% constituent of the total US EV sales. Interestingly, Tesla sold EVs equivalent to the next 15 brands combined and emerged as the sole giant in the market. Based on the research, Counterpoint expects US EV sales to cross 10 million units annually by 2030. Notably, Tesla's Model Y has been the best-selling EV model since the third quarter of 2020.



(Source: Counterpoint Research)

Dec 2022: EV Sales Down by 15% from Nov

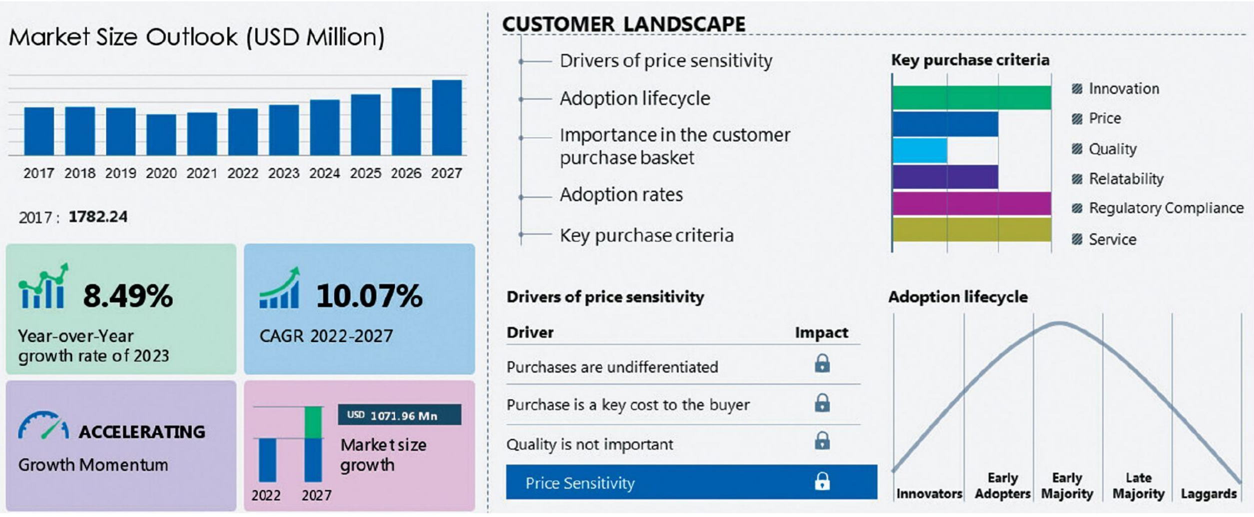
In an update from the Indian electric vehicles industry, the overall EV sales in December 2022 saw a month-on-month decline of around 15% to reach 102,212 units. It was the largest downfall this year, more than what was seen in the month of May when EV sales fell by 9% from the previous month. Notably, the decline in sales of electric two-wheelers (E2Ws) by around 16% and in sales of passenger electric three-wheelers (E3Ws) by about 14% are being considered as the drivers of this pushback in December m-o-m EV sales. However, on the brighter side, EV sales were up by around 100% this month, compared with the same month last year. On a y-o-y basis, the sales doubled in Dec 2022. Registered EV sales in the country were 50,866 units in Dec 2021, but a whopping 102,212 in Dec 2022.



(Source: JMK Research)

2022-2027: Automotive Antenna Module Market Size to Grow by $1,000 mn

As per a latest market research, the automotive antenna module market size is estimated to grow by $ 1,071.96 million from 2022 to 2027. It further added that the market's growth momentum will be progressing at a CAGR of 10.07% during the forecast period. Talking about the key trends, the report mentioned that the increasing craze for cellular V2X technologies and growth in cellular technologies such as 4G LTE and 5G is increasing the scope for testing and adoption of Vehicle-to-everything (V2X) technology. Terming the increasing connectivity technologies in vehicles as the key growth driver, the report observed that the rising consumer demand for entertainment, comfort and other features such as remote diagnostics and ECU software management have increased the penetration of connectivity technologies in vehicles.



Drivers of price sensitivity

Driver	Impact
Purchases are undifferentiated	🔒
Purchase is a key cost to the buyer	🔒
Quality is not important	🔒
Price Sensitivity	🔒

(Source: https://www.prnewswire.com)

ENSURING QUALITY PRODUCT
By Quality Function Deployment

This article describes how to get the framework on product requirements, basic design parameters, a conceptual clarity of various manufacturing processes required, and the quality assurance process. The final product design will, however, require further detailing. It will also require analysis of cost, technology, and business viability

SOUMYANATH CHATTERJEE is former TVS Motors Chair Professor at Industrial and Systems Engineering Department, IIT Kharagpur. His expertise is in Product Development and Supply Chain Management

In my article titled ‘Developing Lovable Products to Beat Competition’ published in January issue I discussed lovable products. A product needs to have certain qualities for being loved. But quality is a very elusive concept. We all understand quality as something that makes the object desirable.

Beyond this universally accepted concept, quality means different things to different people. Some customers may give more priority to the looks, some may prefer more reliability, some others may look for a lightweight product, whereas another group may want one that costs less. To cater to these different needs the product has to address multiple things to be successful in the market.

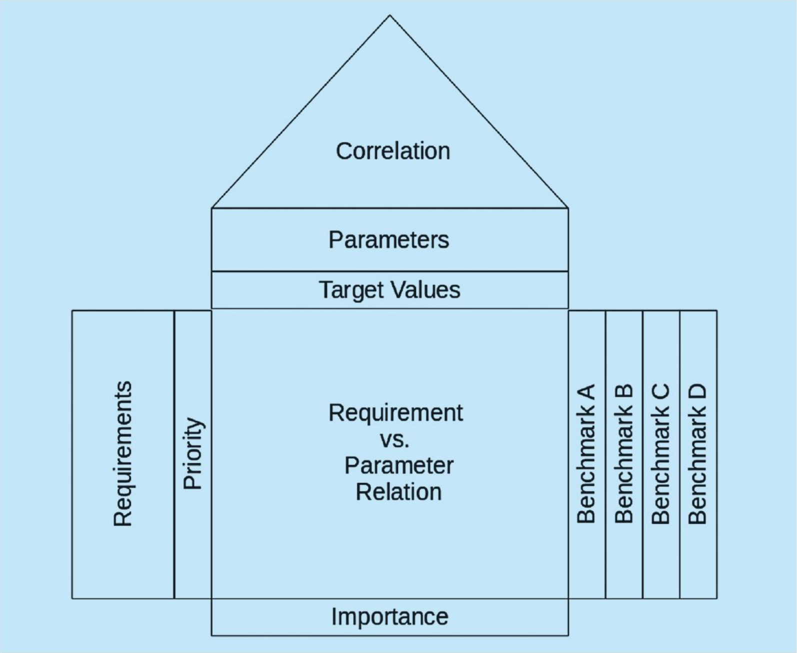


Fig. 1: QFD chart structure

Sometimes, we may need different product models to address these needs. In this article, we shall focus on the process of systematically addressing these varied requirements from a product.

There are various approaches for systematic product requirement analysis. We shall discuss a rather simple and popular technique called quality function deployment, or QFD. This is a process of listing the requirements simply and concisely, comparing various benchmark products, and systematically evolving the product definition and its manufacturing process.

For QFD we start with listing the product requirements. These requirements for a product come from various stakeholders. Part of it is from the people who will buy the product, then we have those who will use the product. Apart from these two groups we also need to address the requirements of those who sell, stock, and transport the product, the need of society at large, and the rules of the land.

If we fail to address all these varied needs, we shall end up with a bad quality product. So, our journey for product development has to start with discovering and documenting all these requirements.

The QFD process uses a set of four charts to systematically evolve the product definition, manufacturing, and quality assurance plans. The first chart is used to evolve product specifications to address the product needs. In this chart (Fig. 1) we list the product requirements in the first column.

Now, all requirements are not equally

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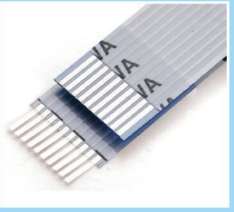
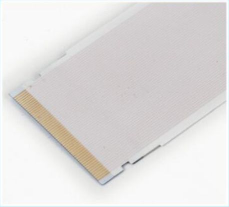


Open end Type for direct soldering



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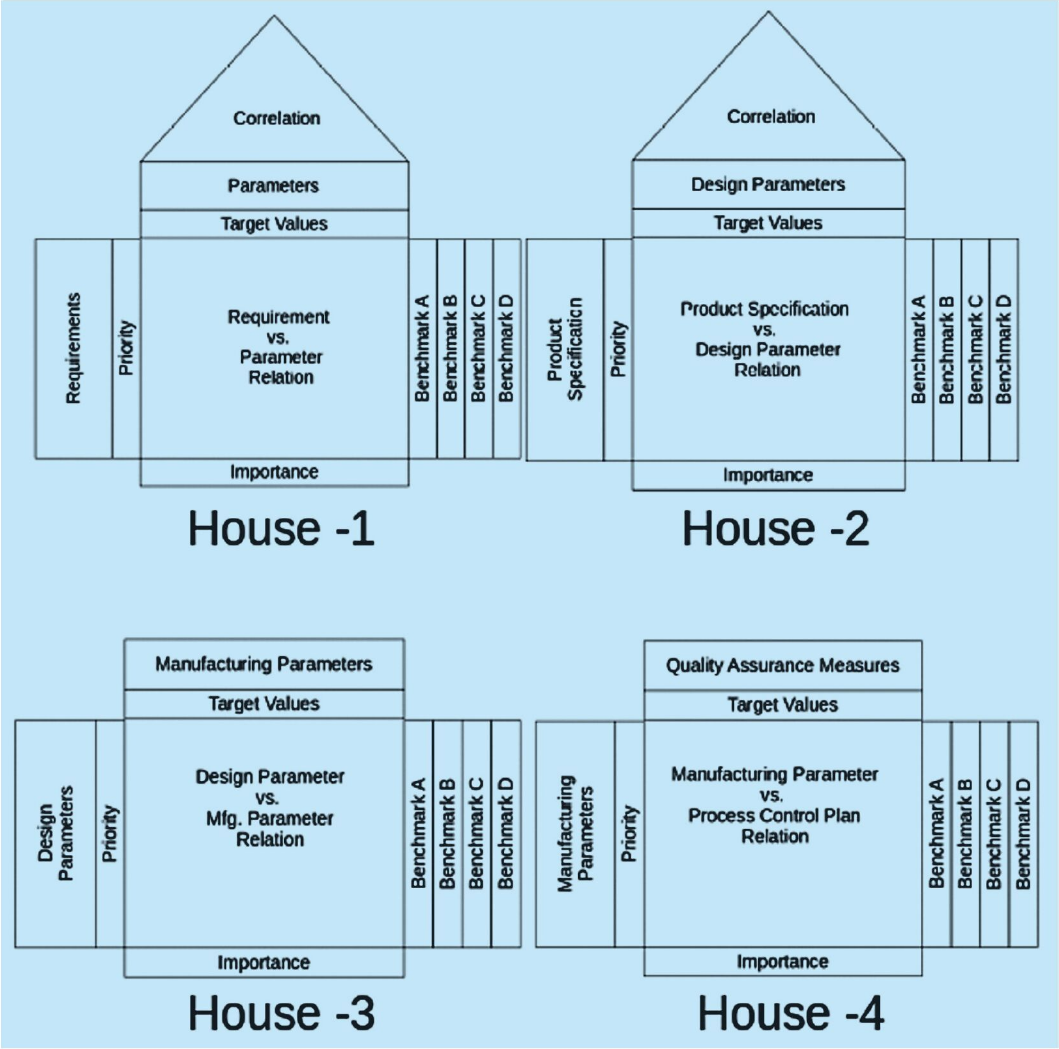
Correlation
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Target Values
Requirements
Priority
Requirement vs. Parameter Relation
Benchmark A
Benchmark B
Benchmark C
Benchmark D
Importance
House -1
Correlation
Design Parameters
Target Values
Product Specification
Priority
Product Specification vs. Design Parameter Relation
Benchmark A
Benchmark B
Benchmark C
Benchmark D
Importance
House -2
Manufacturing Parameters
Target Values
Design Parameters
Priority
Design Parameter vs. Mfg. Parameter Relation
Benchmark A
Benchmark B
Benchmark C
Benchmark D
Importance
House -3
Quality Assurance Measures
Target Values
Manufacturing Parameters
Priority
Manufacturing Parameter vs. Process Control Plan Relation
Benchmark A
Benchmark B
Benchmark C
Benchmark D
Importance
House -4

Fig. 2: Full set of QFD charts

important. Some of the requirements may be just a wish, or what we call nice to have features. Other requirements may be strongly desired and may influence the buying decisions. The third category of requirements is the must-have features. Unless the product has those must-have features it is not usable.

We rate these priorities on a scale of 1 to 10, with 1 being for the least essential and 10 for the most important requirements. Typically, ratings 7 to 10 are reserved for requirements that are necessary for the product. Customers will not purchase the product if these requirements are not fulfilled. The next set of priorities is what sets one product apart from the other. These requirements get a rating between 4 and 7.

The rest of the requirements are what customers will appreciate but will not strongly motivate or influence them to purchase. Such requirements typically get a rating between 1 and 4. Understanding the priority of the requirements is as important as understanding the requirements.

Once we get a fair idea of the requirements and their priority, we should look at the existing products and benchmark and select the combinations of features for the product that we want to offer.

All these features and combinations can be quite confusing and difficult to handle. The QFD process provides a concise and systematic way to handle this huge amount of information. For QFD we create a chart to capture product requirement information. In the first two columns we write down the requirements and their priority. The product needs to have a certain feature to address the requirements.

For example, if we say our charge controller should handle 600W of power at 24V, then the transistor or relay that will divert the power has to be rated for that current and voltage. One feature may address multiple requirements, or one requirement may get addressed by multiple features.

We write down these product features in columns, starting from the third column. We put the number 1 to indicate which of the requirement is addressed by which product feature. At end of the exercise, we should have mapped all the product requirements to product features. After the product feature columns, we write the benchmark products and rate them on performance against the product requirements.

This exercise gives us clarity on which product features address which requirements and the performance of other products against various requirements. In addition to the captured information, we calculate the relative importance of the product features by taking the weighted sum of the product of

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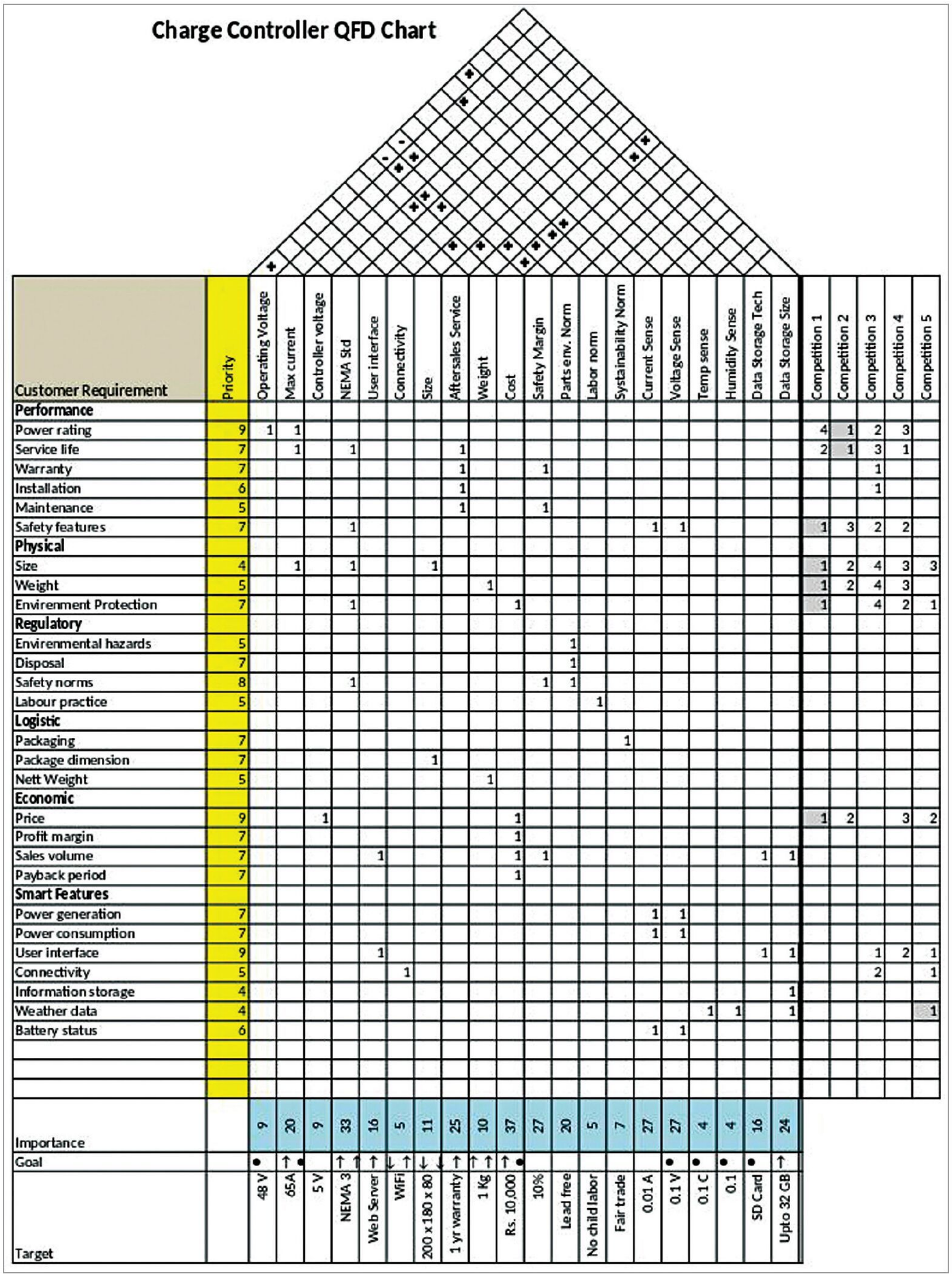


Customer Requirement	Priority	Operating Voltage	Max current	Controller voltage	NEMA Std	User interface	Connectivity	Size	Aftersales Service	Weight	Cost	Safety Margin	Parts env. Norm	Labor norm	Systainability Norm	Current Sense	Voltage Sense	Temp sense	Humidity Sense	Data Storage Tech	Data Storage Size	Competition 1	Competition 2	Competition 3	Competition 4	Competition 5
Performance																										
Power rating	9	1	1																			4	1	2	3	
Service life	7		1		1				1													2	1	3	1	
Warranty	7								1			1												1		
Installation	6								1															1		
Maintenance	5								1			1														
Safety features	7				1											1	1					1	3	2	2	
Physical																										
Size	4		1		1			1														1	2	4	3	3
Weight	5									1												1	2	4	3	
Envirenment Protection	7				1						1											1		4	2	1
Regulatory																										
Envirenmental hazards	5												1													
Disposal	7												1													
Safety norms	8				1							1	1													
Labour practice	5													1												
Logistic																										
Packaging	7														1											
Package dimension	7							1																		
Nett Weight	5									1																
Economic																										
Price	9			1							1											1	2		3	2
Profit margin	7										1															
Sales volume	7					1					1	1								1	1					
Payback period	7										1															
Smart Features																										
Power generation	7															1	1									
Power consumption	7															1	1									
User interface	9					1														1	1			1	2	1
Connectivity	5						1																	2		1
Information storage	4																				1					
Weather data	4																	1	1		1					1
Battery status	6															1	1									
Importance		9	20	9	33	16	5	11	25	10	37	27	20	5	7	27	27	4	4	16	24					
Goal		●	↑ ●		↑ ↑	↑	↓ ↑	↓ ↓	↑	↑ ↑	↑ ●						●	●	●	●	↑					
Target		48 V	65A	5 V	NEMA 3	Web Server	WiFi	200 x 180 x 80	1 yr warranty	1 Kg	Rs. 10,000	10%	Lead free	No child labor	Fair trade	0.01 A	0.1 V	0.1 C	0.1	SD Card	Upto 32 GB					

Fig. 3: Product specification QFD

priority number and product feature mapping.

These numbers tell us which of the product features are very important and which are not so important. The importance ranking is required to save time and highlight the important features of the product.

The next task of the QFD process is to find the interactions between different product features. Some features are positively co-related whereas some other features may be negatively correlated. For instance, we may use drivers with higher power ratings to make our product robust and reliable, but that higher-rated item may be costly, which will diminish the attraction of our product. Clarity on how different product features are related is an important step before we decide on the target specifications of our product.

To decide on the target specifications, we need to use the feature importance number. Important features should be decided after careful study and prototyping. Target on less important features may be decided based on a comparative feature study of the competition.

We start with various requirements of the product, such as:

Performance. Power rating, service life, reliability, installation, and maintenance

Physical. Size, weight, environment

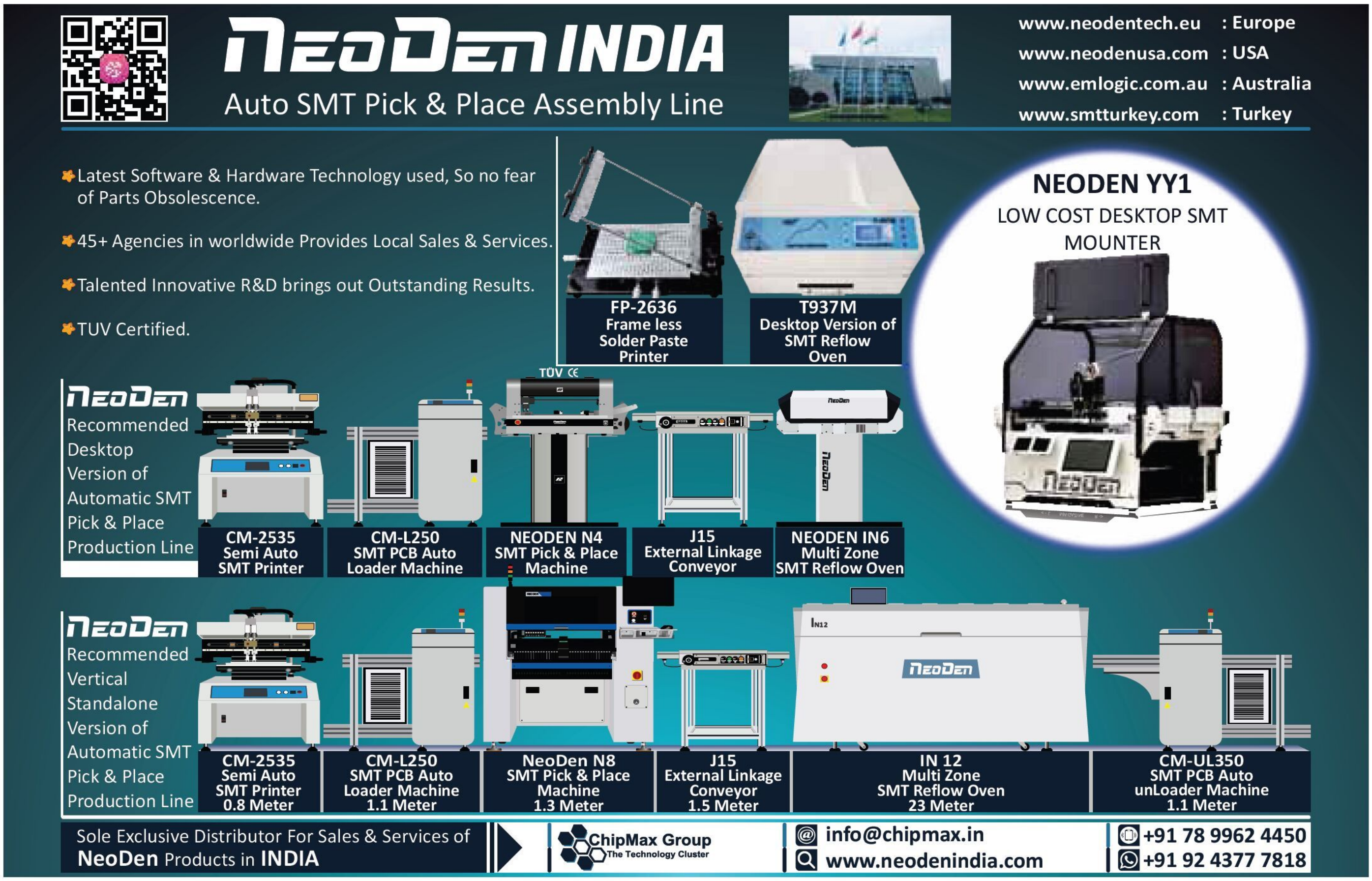
Regulatory. Environmental hazards, safety norms, disposal

Logistic. Packaging, protection, physical dimensions

Economic. Price, profit margin, sales volume

Apart from these basic requirements we also need to provide features that make the product attractive. In our previous article we explained how we can increase the attraction of our charge converter by making it smart. We need to consider those interactive features as well.

At the end of careful consideration of various product features, we finally get a list of the required product features. QFD process captures the information and the final outcome in a single chart and clearly shows how the product requirements are addressed by prod-



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uct features. While requirements are a little vague, product features give us specific figures that form the basis of product design. The filled QFD chart for the charge converter (Fig. 3) shows this process.

For the sake of commercial confidentially I have changed the competitors' product names and instead called them Prod. A, Prod. B, etc. The highlighted cell indicates where we want our product to be in terms of the requirements. The triangular portion shows the corelations between different product parameters. Just below the parameters, we write the target values for the product.

We shall take a specific example to show how the product specification is determined. In the requirement, we noted that the charge converter should be able to handle the power requirement for a small family. Looking at the other benchmark products we find the rated power varies from 500W to 1,200W.

We want our product to be of premium quality and so decided that it should be able to handle 1,500W power from the alternator. It is also decided that the operating voltage of the converter will be 48V. This gives the current rating as 1500W/48V = 31.25 amps. We add a 10% safety margin and set the product specification as 35 amps and 48 volts.

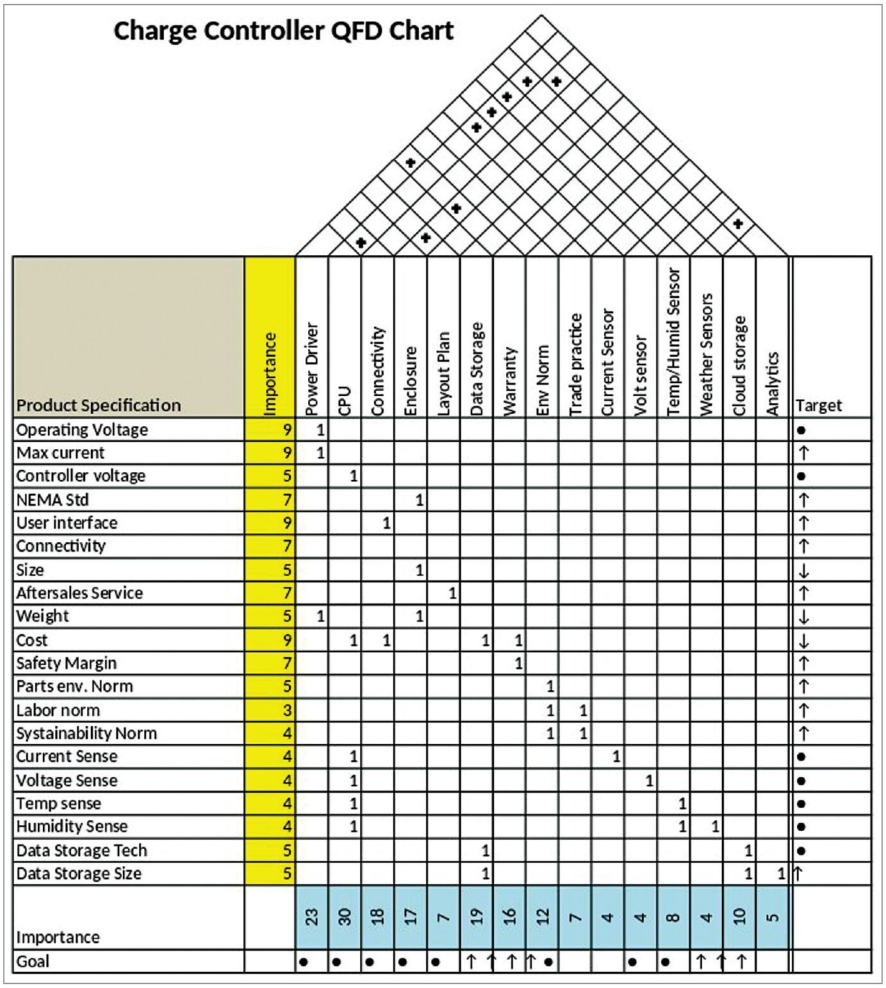
The QFD process uses four such charts to describe the complete product development plan (Fig. 2). In the QFD jargon, we call these charts a house.

The first house is used to arrive at the product specifications from the product requirements. While product requirements are generic and qualitative, product specifications are more quantitative values. In the second house, we translate the product specifications into product design parameters. The third house gives us the manufacturing plan and the fourth house gives us the quality assurance plan. These four charts together describe the high-level product development plan.

Fig. 3 shows the QFD chart for the first house. Here we derive product specifications from the list of requirements. Requirements are the list of things that we want our product to perform. We list different requirements in the first column of the QFD and then take an evaluation on the priority of these requirements.

Rating 7 to 9 are reserved for requirements that are in the "must have" category. Rating 1 to 3 is a "nice to have" kind of requirement. These ratings indicate that customers would not care much about the requirement. The rest of the requirements are rated between 4 and 6.

Next, try to figure out the product features which will address the


Charge Controller QFD Chart

Product Specification	Importance	Power Driver	CPU	Connectivity	Enclosure	Layout Plan	Data Storage	Warranty	Env Norm	Trade practice	Current Sensor	Volt sensor	Temp/Humid Sensor	Weather Sensors	Cloud storage	Analytics	Target
Operating Voltage	9	1															●
Max current	9	1															↑
Controller voltage	5		1														●
NEMA Std	7				1												↑
User interface	9			1													↑
Connectivity	7																↑
Size	5				1												↓
Aftersales Service	7					1											↑
Weight	5	1			1												↓
Cost	9		1	1			1	1									↓
Safety Margin	7							1									↑
Parts env. Norm	5								1								↑
Labor norm	3								1	1							↑
Systainability Norm	4								1	1							↑
Current Sense	4		1								1						●
Voltage Sense	4		1									1					●
Temp sense	4		1										1				●
Humidity Sense	4		1										1	1			●
Data Storage Tech	5						1								1		●
Data Storage Size	5						1								1	1	↑
Importance		23	30	18	17	7	19	16	12	7	4	4	8	4	10	5	
Goal		●	●	●	●	●	↑ ↑	↑ ↑	●			●	●	↑ ↑	↑		

Fig. 4: Second QFD house—Design parameters

requirements. These features we put in the columns starting from the third one. We also put a mark '1' to indicate which product features address which requirements. There can be more than one feature to address a particular requirement. Also, one feature may address multiple requirements.

Next, we compare our target product with the ones that are available in the market. Competitions 1 to 4 are existing charge controllers. We took a weather station to compare the features of connectivity and user interface (Competition 5). We rank the product against the requirements. Shaded cells indicate the features that we selected for our product.

But, before selecting the target feature, we must complete the top portion, the roof. The triangular section shows how different product parameters are related. For instance, higher operating voltage has a negative effect on cost and safety margin. Higher current on the other hand will push up cost and safety margin.

Once we get a clear picture of the various interactions then we can select which required feature from the customer will be most suitable for our target product. As you see here, it is not necessary to take all the features from a single product. Some of the features we may decide to use can be our own.

Next, we compute the importance index of the parameters. These parameters address multiple important requirements. For instance, in our case, cost, followed by NEMA Standard, are the most important parameters. Based on the competition benchmarking we then decide our target values for each of the parameters.

Finally, we decide that our charge controller will be for a 48V alternator with a max current rating of 65A. It will have NEMA 3-level environment protection and housed in a 200mm × 180mm × 80mm box. It should weigh around 1kg and cost around ₹10,000. It will save data on an SD card and have a Wi-Fi connection to send operation data to a cloud server.

We must mention here that at this juncture the values that we select are just indicative figures that we picked up from the comparison of similar products from the market. Subsequent steps of design help us to validate, modify, and get further details of the product design.

In our next step, we use the product specification information to get the first-level design specifications. Product specifications are things that are visible to the customer. Design specifications are details that tell us how to make the product. Design specifications are the internal details that are not visible to the customer.

For getting the design specifications, we start with the list of product specifications. This is the set of features that needs to be delivered by our product. Next, we give an importance rating of the product specifications. Some practitioners recommend using the same importance figures that we got in the first chart.

Product design is primarily an engineering design exercise. One should not blindly follow the figures that have come from intuitions and group opinions. In my experience, re-evaluation and moderation of the importance figures in the second

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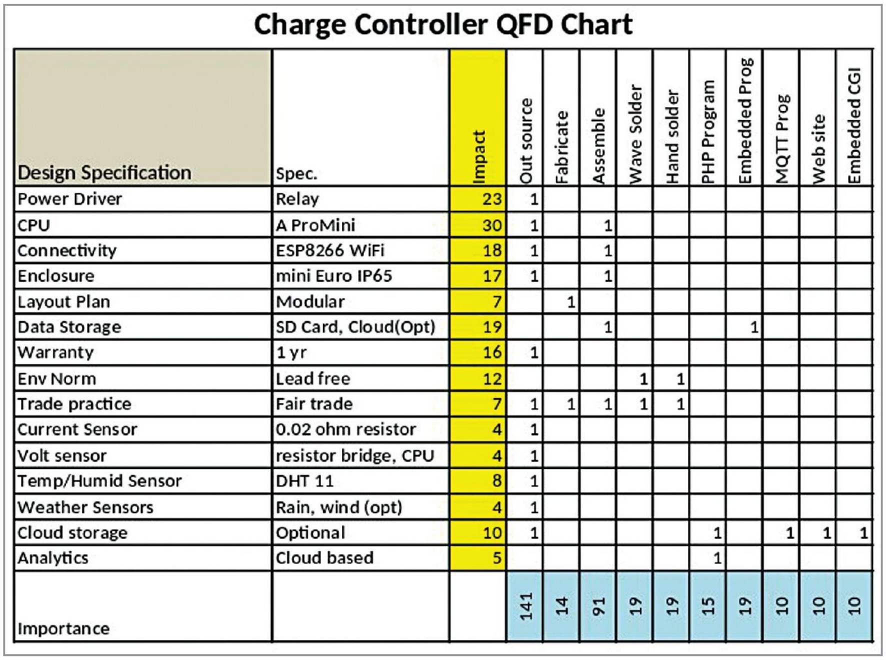
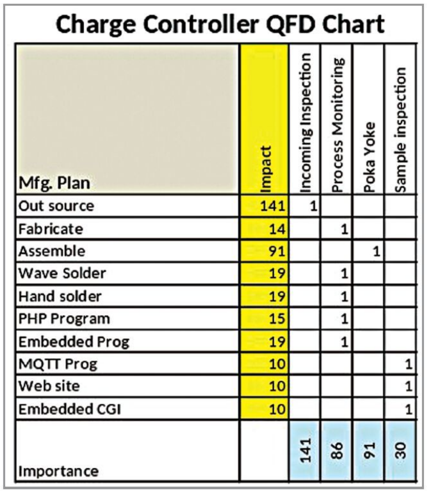


Charge Controller QFD Chart

Design Specification	Spec.	Impact	Out source	Fabricate	Assemble	Wave Solder	Hand solder	PHP Program	Embedded Prog	MQTT Prog	Web site	Embedded CGI
Power Driver	Relay	23	1									
CPU	A ProMini	30	1		1							
Connectivity	ESP8266 WiFi	18	1		1							
Enclosure	mini Euro IP65	17	1		1							
Layout Plan	Modular	7		1								
Data Storage	SD Card, Cloud(Opt)	19			1				1			
Warranty	1 yr	16	1									
Env Norm	Lead free	12				1	1					
Trade practice	Fair trade	7	1	1	1	1	1					
Current Sensor	0.02 ohm resistor	4	1									
Volt sensor	resistor bridge, CPU	4	1									
Temp/Humid Sensor	DHT 11	8	1									
Weather Sensors	Rain, wind (opt)	4	1									
Cloud storage	Optional	10	1					1		1	1	1
Analytics	Cloud based	5						1				
Importance			141	14	91	19	19	15	19	10	10	10

Fig. 5: Third house—Manufacturing plan



Charge Controller QFD Chart

Mfg. Plan	Impact	Incoming Inspection	Process Monitoring	Poka Yoke	Sample inspection
Out source	141	1			
Fabricate	14		1		
Assemble	91			1	
Wave Solder	19		1		
Hand solder	19		1		
PHP Program	15		1		
Embedded Prog	19		1		
MQTT Prog	10				1
Web site	10				1
Embedded CGI	10				1
Importance		141	86	91	30

Fig. 6: Fourth House—Quality Assurance plan

stage give better focus on the design process.

In the second house, we list the high-level design parameters in the columns and then map these parameters to product specifications. In the end, we examine the co-relations between design parameters and decide on the design parameters.

Design specifications and the decided specifications we list in the third house, the manufacturing plan. Design and manufacturing plan must emerge together. One needs to look at various alternatives, work out production volume, and then decide on the most profitable manufacturing route. The cost of the part as well as the production costs have to be worked out before we take the design decision.

The charge controller needs to handle rather a large current. The frequency of switching on/off is less. All the competitions use a relay for this operation. We also decide on a relay for the main current driver operation. In our device, we need to sense two analogue voltages and get data from the humidity and temperature sensor using an i2C connection.

As the expected production volume of our product is small to medium, we select a readily available microcontroller module, namely, Arduino Pro-Mini. For internet connectivity, we select a companion Wi-Fi chip, ESP8266. Likewise, we decide on enclosure, sensors, environment norms, and software options. These details are put in the third QFD chart (Fig. 5).

The third chart help us prepare the manufacturing plan for our design. Here we put the manufacturing process in the columns and figure out the manufacturing processes for various parts. In the impact column, we use the figures from the second QFD chart. Summation of the impact factors gives us the importance of manufacturing processes. Manufacturing processes that have a high impact on the product need close monitoring to ensure quality.

In the fourth house, we decide on the quality assurance plan for our product. Here we decide how to monitor the process and ensure the quality of the output. As you see in Fig. 6, we may adopt a similar quality control strategy for multiple production processes.

Like our previous step, the importance value of stage 3 becomes the impact of stage 4. The summation of relevant impact factors gives importance to the quality control process. A quality process with high importance value, like the incoming inspection in our case, needs to be given more focus. We need to develop elaborate plans to ensure proper control.

These four QFD charts give us conceptual clarity of our product design. QFD process ensures that all stages of product design, manufacturing, and quality assurance stay aligned with the customer's requirements.

What we got after this exercise is the base-level product concept. It is a framework on product requirements, basic design parameters, a conceptual clarity of various manufacturing processes required, and the quality assurance process. It is not the final product design.

The final product design will involve further detailing. It will also require analysis of cost, technology, and business viability. Finally, product and business validation has to happen. In our next articles, we shall explain these processes that are needed for successful product design. EFY

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MANAGING E-WASTE OF EV BATTERIES: A Challenge As Well As Opportunity

Every challenge presents opportunities for new businesses and business tycoons. E-waste of EV batteries seems to be one such case

VAISHALI YADAV

It is well-known that lithium-ion batteries constitute the core of electric vehicles (EVs), but it is equally well-known that the landfills are full. So, where will the batteries be dumped after their use?

Understandably, the calls for circularity, which involves the recovery of resources from the so-called waste, are gaining traction. To figure out the challenges and opportunities presented by this trend, this report, based on some industry events, puts across some facts that need to be considered.

First, let's look at the prominent trends related to the use of batteries in EVs and their e-waste.

The trends

- India is moving toward renewable energy sources rather than relying on the conventional energy sources that are riddled with challenging geographical and geopolitical issues.
- The Indian market is growing at an exponential rate. Also, EVs are trending. So, the demand for lithium-ion batteries is set to boom.

RECOVERY TARGETS FOR BATTERIES

Type of battery	Recovery target for the year in percentage		
	2024-25	2025-26	2026-27 and onwards
Portable	70	80	90
Automotive	55	60	60
Industrial	55	60	60
Electric vehicle	70	80	90

***Note.** Maximum recovery target is subject to the percentage of non-recoverable hazardous material content in the battery. It would mean the reduction of recovery target by the same percentage of the hazardous material present in the waste battery.*

Recovery of minimum percentage target is the percentage of the total weight of all recovered materials out of the dry weight of the battery. Recyclers shall be mandated for minimum recovery of battery materials, as mentioned in the Table, under Battery Waste Management Rules, 2022.

- Before 2017, lithium-ion batteries existed in the market but the quantum of these batteries has vastly increased from the time electric mobility came into the picture.
- The annual lithium-ion battery potential from EVs is likely to reach 130 gigawatt hours (GWh) in India by FY2030, from 5GWh as of FY2022.
- At present, EVs account for a 30% share of the overall lithium-ion batteries' deployment in India. By 2030, the share is expected to increase to 60%.
- Within EVs, electric 2-wheelers will be the major segment which will hold a majority share of over 80% by 2030. The electric 3-wheelers will also have a substantial share.
- On the basis of this demand for lithium-ion batteries, their recycling market potential in India is expected to cross 48GWh by 2030.
- The lithium-ion batteries can be recycled as well as refurbished for reuse.
- From the perspective of recyclers, the majority of scrap coming out in India is from mobile phone batteries. The electric 2-wheeler batteries have started coming in, but these have NMC (nickel, manganese, and cobalt) cells.
- In the case of electric 2-wheelers and electric 3-wheelers, nearly 75% of such batteries are being recycled and the rest 25% are estimated to be used for a second life, like behind-the-meter (energy production and storage systems that directly supply homes and buildings with electricity) applications.
- In the case of e-cars and e-buses, second-life usage is as high as 60%.
- The battery recycling process entails pre-treatment, which constitutes the thermal process and mechanical processes. Then comes post-treatment, for which two technologies are deployed: pyrometallurgy and hydrometallurgy. In India, hydrometallurgy is the most used. Direct recycling is also possible, which is more favourable for LFP (lithium iron phosphate).
- Lithium nickel manganese cobalt (NMC) oxide batteries' chemistry provides higher energy density, low weight, etc, while LFP provides higher safety and better cycle life. We are moving more towards LFP but there isn't much to recover here.
- We are going through this technological evolution. Some other chemistries will also come soon. The suitability for the recycling is going to be determined by the original equipment manufacturers (OEMs) themselves.

The challenges

Here's a list of challenges posed by the increasing sale of EV batteries:

- Limited resource availability is a challenge. As the government of India is pushing for local manufacturing of lithium cells, demand for raw materials is expected to grow significantly. But, currently, there are no local resources for such rare metals in India.
- A major challenge is related to the material coming out through the first level of recycling. It is very difficult to check if the black mass generated out of recycling would have the same specifications which are being promoted and provided by these mechanical recycling players.
- The idea of tapping the B2C segment by recyclers is also logistically inconceivable. Only battery manufacturers can tap the market through extended producer requirement norms, if imposed strictly.
- Geopolitical risk, war, and the pandemic are creating additional threats that are disrupting the supply-chain. The global supply-chain, especially China's, is resulting in a long lead time for raw material deliveries.
- The most important challenge is the high cost, huge upfront costs involved in setting up recycling plants, and high processing costs that are becoming the main deterrents.
- We do not yet have enough batteries that have actually gone through the cycle life to really talk about the critical mass.
- Unlike a traditional lead-acid battery, a lithium-ion battery, if not fully discharged before it goes for black mass, is bound to create problems. Being handled by the informal sector is a disaster in making.
- The process of recycling EV batteries is still in the learning phase. Dismantling and recycling of batteries present a huge task in terms of setting up facilities for the production of the black mass or derivatives, such as cobalt sulphate, nickel sulphate, and lithium carbonate.
- In terms of channelisation, battery recycling is still being handled by the large informal sector, which was earlier handling the e-waste, because significant battery supplies are from smaller devices like smartphones, other gadgets, and power tools.
- There are multiple channels before a battery reaches the end recycler. There are a lot of leakages in the system, which make it an inefficient process.
- There are no guidelines from the government for second-life bat-

tery packs. If you make any of these battery packs, they're still considered first-life packs.

- Not many refiners are available to extract the metals like cobalt, lithium, and graphite, which are not naturally available in India to be mined.
- On the international front, there are restrictions being imposed by the countries where these are available.
- Ensuring that standards are met for collection, and ensuring safe handling and transportation is another challenge.

The opportunities

Here is the list of opportunities that could give rise to new businesses:

- There's a huge potential for material recycling, which is nascent and will be increasing multi-fold in future.
- Batteries will not just die like that after use in electric vehicles. They will be first used in their second life before going for recycling, because these have high-end, high-purity, and high-material cells.
- Direct recycling, that is, cathode to cathode recycling, is possible and it is most favourable for LFP. So that is a technology on which the recyclers need to work in India jointly.
- India has a huge opportunity for battery-grade refiners, the technology for which is yet to come to India from the countries like Japan, China, and Korea.
- There is a significant market for second-life batteries because 60-80% of energy is left in the cells, which can be used in toys, inverters, etc. This presents a big opportunity for dealers, service centres, and other authorised channels.
- Foreign investors are showing a lot of interest in the recycling sector in India due to India's huge consumer and increasing consumption of lithium-ion batteries.
- Indian recycling firms have the chance to partner with foreign companies and get exposed to technology as well as entire network of partners.

Government's role

Here's the list of things expected from the Central and state governments, as these are all policy-related:

- Skilling the workforce and explaining them the chemistry of lithium-ion is important.
- Lithium-ion battery dismantling and recycling is a different game altogether and requires different regulations in place. Removing lithium is not the same as removing PCB from a mobile phone.
- There needs to be a mechanism to incentivise and ensure that the recycling is done properly and that the customers can return their batteries and collect the money.
- Battery Waste Management Rules, 2022 are a step in the right direction for the recyclers, refurbishers, producers, and importers. They prohibit landfill disposal and incineration of depleted batteries. The efficacy of implementation is going to be the most important factor, however.
- The centralised online portal is crucial to fix end-to-end responsibility. Making sure that there is traceability of the batteries through this online portal is going to be critical.
- There should be some kind of check for not just the kind of extraction and efficiency of the technology, but also for the emissions.
- We have a lot of things to learn from the lead-acid battery market. Lead in batteries had to be handled carefully, but its implementation become very localised, dominated by the recyclers.
- It's better to make and announce policy beforehand to prevent germination of the unorganised sector in this domain.
- Government should help standardise the procedure and set a benchmark.

Way forward

Here are some suggestions for the industry:

- Look at the waste as a raw material.
- We don't manufacture many lithium-ion batteries. So, whatever gets recycled, rather than exporting to foreign refiners, we should refine it within our country and benefit from that.
- We need to have a strong reverse logistic system to develop a supply-chain network and let the aggregators and partners work as collectors.
- The recycling cost will be high, but the benefits will be higher, but for that the scale has to be achieved, and one needs to have over 90% efficiency extraction targets.
- Batteries from electric 2-wheelers and electric 3-wheelers can be used for stationary applications like solar storage stations, or can be directly sold to manufacturers in the toy industry.
- If they are in good shape and are not damaged, 4-wheeler battery cells can be used for electric 2-wheeler and 3-wheeler batteries, which can run well for 18-21 months.
- The recyclers should form an association to fix uniform pricing and to procure the raw materials. The customers, who are the end users, should get a reasonable buyback value so that it becomes an entirely sustainable ecosystem.
- International entities can set up their recycling facilities in India with the help of local partners, which could help introduce the latest techniques here.
- Recyclers should work together instead of competing with each other. That will help in regulating battery prices and increase profitability for the recyclers. **EFY**

Vaishali Yadav, a journalist at EFY, muses upon clouds, security, sustainability, integration, smartness, machines and learning—both trivially and technologically.

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INDIGENISING 5G COMMUNICATION WITH OPTIMUS RHINO 5G

Defence startup OptimusLogic Systems, based in Bengaluru, is making waves across all bands of the 5G spectrum with their indigenously designed 5G mobile phone

optimus rhino 5G
optimus rhino

The team at OptimusLogic Systems with their founder Chandra Kumar Chettiar (centre)

Throngs of people and the telecom behemoths bore witness on October 1, 2022, as India was ushered into a new era of technological advancements with the inauguration of the 5G band, at the 6th Edition of India Mobile Congress 2022, at Pragati Maidan, New Delhi. On this momentous occasion, a small but enterprising group of individuals unveiled India's first indigenously manufactured 5G smartphone—Optimus Rhino 5G.

Founded in 2013 by Chandra Kumar Chettiar as a startup that built devices and subsystems for defence PSUs such as BEL and DRDO, OptimusLogic Systems Pvt Ltd began their journey with an initial investment of ₹20 million. As a Digital Communication Innovation Square (DCIS) scheme grantee, and with the support of the Department of Telecommunications (DoT), the company has been able to manufacture a 5G smartphone that can support all the 5G bands in a very small form factor.

The phone is currently available in three different models—Optimus Rhino 5G 1, Optimus Rhino 5G 2, and Optimus Rhino 5G 4 (rugged MIL-810G/IP68).

Out of the total smartphone base of about 600 million in India, only 50-60 million handsets are estimated to be 5G smartphones, even as the first 5G smartphone was unveiled in 2020. The Optimus Rhino 5G is an indigenous product of the Voice of Indian Communication Technology Enterprises (VoICE) consortium, which asked multiple technology and R&D players to set up a 5G based mobile communication network in the 82km Palwal-Mathura sector of the Indian Railways on 700MHz band.

"Most of the phones manufactured by a consumer brand support the N78 (3500MHz) frequency band. If you take multiple use cases for the army and the railways, they have been allotted the 5MHz spectrum in the 700MHz band, because the lower the frequency, the higher the range. Optimus Rhino 5G supports all these bands and global network bands of major countries," explains Chettiar.

The Optimus Rhino 5G 1 comes with a large storage capacity of 8GB RAM, 128GB flash drive, and a quad camera setup at a modest price of ₹20,000. Consumers also have the option of getting a discount of ₹2,000 if they choose to assemble the phone on their own and order the assembly kit.

It has an octa-core MediaTek Dimensity 900 processor and an ARM Mali-G68 graphics processing unit. It supports 17 5G bands starting from B1 to N78. The phone can connect with a 5G network anywhere across the globe in standalone (SA) and non-standalone (NSA) modes.

With a 17cm (6.7-inch) in-cell display and an FHD+ resolution (1080 × 2460 pixels), the phone supports 120Hz refresh rate for smoother animations and scrolling experience. The Android 12 mobile phone runs on a 5000mAh lithium-polymer battery with a standby time of 200 hours. It comes with a built-in NFC; the later models will use the Indian Regional Navigation Satellite System (IRNSS) navigation system NavIC.

The designing of the phone began in 2020 when the world was grappling with Covid. Due to their association with the defence sector, the company worked throughout the pandemic, with salary cuts to generate funds for designing and developing the phone.

optimus RHINO
OPTIMUSLOGIC
optimus rhino 5G

The Optimus Rhino 5G 1

Chettiar and his team are currently readying themselves to market the product and showcase it in various exhibitions. "We are already running a test run across the government departments, where about 10,000 phones will be tested for working in India. Once we cross that we shall be ready for mass production," says Chettiar.

While the PCB was designed in-house, the outsourced components were assembled in their office. The team intends to target the consumer market and defence PSUs in the initial marketing stage. It is currently in talks with VVDN Technologies for a commercial manufacturing facility for the phone. The company plans to subsequently white-label the PCB design for different platforms and sell it to other companies.

The team outlined the company's vision with the prospect of approaching venture capitalists to set up their manufacturing unit. "Our vision is to be a global original design manufacturer (ODM) and design devices for the world. As our clientele increases, we will aim to set up a general-purpose manufacturing unit, which will not be targeted specifically to a particular device but support any embedded system design," the team told EFY.

—*Yashasvini Razdan*

2

INTEGRATING ELECTRONICS WITH FASHION AND LUXURY

Gurugram based tech startup Arista Vault innovatively integrates technology with wallets and bags to provide wealth and data security with a 'Made-in-India' sleek touch

What may happen when a person loses his wallet? As unthinkable as it may sound, a data and wealth security company may come up. And that's the origin story of Arista Vault, a 2017-born Indian startup. Retired Army Col. K.K. Singh onboarded designer Purvi Roy and the wallet-loss victim and finance guy Atul Gupta to launch this venture to create something unusual in India. The startup designs and develops smart wallets laced with embedded chips and signature circuit designs to prevent its loss.

Arista, in Sanskrit, means un-

Arista Vault

Arista Vault team

hurt. "We are dedicated to the safety and security of the common people so that when they hustle, they don't lose things. Features like loss alarm and location tracking are all embedded in the slim and user-friendly wallet made with design-engineered leather," said Purvi.

Reportedly, 2.5 million mobile phones and wallets get lost each year in India. Arista Vault surveyed Delhi Metro and Mumbai locals to test the waters and got an affirmative public response to bring a security mechanism for their money, IDs, and other valuables.

In the beginning, the prototype of their entire Internet of Things (IoT)-enabled mechanism was big and bulky. But the dedicated R&D team, which Purvi considers to be the company's USP, came up with a compact circuit design and schematics, making the final product look sleek from the outside but implanted with a lot of technology inside. The company claims that its average wallet weighs around 120gm and has a 3-year-long in-built battery life. But those with a mobile charge feature need charging. The pricing of these smart wallets starts at ₹1,200 and goes up to ₹7,000.

Wallet-Bot Classic

The Classic Wallet of Arista Vault has a power button which activates the features like anti-loss, anti-theft, distance tracking, and location tracking. Interestingly, the wallet has a mobile charging feature as well. "The Classic Wallet comes with a 3,000mAh power battery, which remains charged for around three days continuously, after which it needs charging," mentions Purvi.

The company, which identifies itself as India's first to introduce a smart luggage range, got its first funding and support from the Ministry of Electronics & Information Technology (MeitY) in 2019, with the Electropreneur Park providing all the infrastructure support to their budding entrepreneurial journey. It recently got major funding from Germany based angel investors and UK based venture capitalists. The company prefers interns over experienced employees for tech, marketing, and designing domains and provides proper training to them.

Housing numerous smart product companies, the US provides the toughest competition to this Made-in-India company. Being a woman adds more to the trouble of entrepreneurship. Purvi feels that women have to prove their mettle in the industry before people take them seriously. She believes Indian companies should hire designers for their tech products because that creates a significant first impression on people's minds.

Arista Vault has its corporate office in Gurugram near Delhi and an outlet in Goa, but it majorly sells its products online and in the B2B market. Finding it tough to sell its products even in the local market in its initial days, the company recently got a call from Amazon to place its product in the US warehouses.

"The Gulf market has been our silver lining during the pandemic. Now, we want to cover 11 major countries globally," says Ruchi, while also wanting to unveil Arista Vault's experience centres in India soon. The startup is also building distributor channels to expand the reach of their smart wallets and luggage.

Arista Vault plans to launch 5G and LoRa technology-enabled products in the coming years. Noting the company's near-future plans, Ruchi disclosed, "We're coming up with 15 more products related to the personal safety of women, work efficiency, health, and lifestyle."

—Vaishali Yadav

3

ADDING THE EDGE IN EMBEDDED EDGE MARKET WITH SIMA.AI

SiMa in Hindi means edge, which is what SiMa.ai has brought to the embedded edge market by integrating machine learning on an SoC

The edge computing market has witnessed an exponential increase in demand post the Covid pandemic. A recent study by Markets and Markets Research reported that the embedded edge market is expected to reach $101.3 billion by 2027 at a CAGR of 17.8%. The hardware segment is expected to largely contribute to this growth.

The challenge faced by this exponential growth is the complexity of integrating edge computing applications and platforms with the existing architecture. The classic system-on-chip (SoC) companies need to adopt machine learning (ML) to meet the rising demands of computing performance and cost.

This is where San Jose based startup SiMa.ai enters the picture

Founder Krishna Rangasayee (in blue) with India's core team at Sima.ai

with its purpose-built platform, which deploys effortless ML and scaling at the edge for computer vision applications at very low power. Born in India, founder Krishna Rangasayee led a semiconductor business at Xilinx, worth more than $25 billion, for 18 years, before deciding to propel the world into a new era of disruptive semiconductor technologies.

The machine learning company has come up with the industry's first software-centric purpose-built Machine Learning System-on-a-Chip (MLSoC) platform focused on computer vision applications.

The MLSoC is built on 16nm technology featuring low operating power and high ML processing capacity. Its processing system consists of computer vision processors for image pre- and post-processing. It has a dedicated machine-learning accelerator (MLA) that offers 50 tera-operations per second (50 TOPS) for neural network computation at 10 TOPS/W. It has a cluster of four Arm Cortex-A65 dual-threaded processors forming its application processing unit (APU), operating at 1.15GHz to deliver up to 15,000 Dhrystone million instructions per second (DMIPS) for high-performance application processes.

Rangasayee says that the MLA offered a class of performance of 50 TOPS at 5W. "If people only want to dissipate 3W, we cap the performance, so that it fits the 3W envelope. We can optimise for performance or power. There are trade-offs in terms of how much utilisation and performance you get, and we give customers that choice," he explains.

The chip's video processing unit comprises a video encoder and decoder that supports the H.264 compression standards, HEVC (high-efficiency video coding) with support for baseline/main/high profiles, 4:2:0 pixels, and 8-bit precision for real-time intelligent video processing. Surrounding the video processing unit are memory interfaces, communication interfaces, and system management—all connected via an Arteris network on chip (NoC).

Sima.ai's MLSoC

With a team of 133 innovators, spread across three locations in San Jose, Bengaluru, and Europe, SiMa.ai is backed by top investors such as Fidelity and Dell Technologies Capital. In addition, the company has hired skilled innovators in Ukraine on a contractual basis.

The company has partnered with Taiwan Semiconductor Manufacturing Company (TSMC) and has Moshe N. Gavrielov, who is on TSMC's board of directors, as its chairman. The four-year-old company has navigated its way through the pandemic and geopolitical tensions to come up with a solution to address any computer vision problem at the lowest power.

The MLSoC can function as a standalone edge based system controller or can be added to a machine learning offload accelerator for processors, ASICs, and other devices. "Today we can compile more than 120 networks in robotics, automotive, unmanned aircraft, etc. We can work with any machine learning framework such as TensorFlow, Caffe, PyTorch, or ONNX. We could take any neural net or ML model, any frame rate, or any resolution," Rangasayee elaborates.

The company is shipping its MLSoC platform, while simultaneously working on Generation 2 of the chip. As Rangasayee frames it, "I think, in our industry, the gift of doing a good job is you have to do it again, better. So, we are working on Gen 2 and we are building an amazing Gen 2 as well."

With bandwidth and computing needs far outpacing the capacity for traditional computing, SiMa.ai has come up with an excellent solution to catapult the embedded edge industry from classic computer vision computing into a machine learning mode. EFY

—Yashasvini Razdan

The Thing That Generates CASH-FLOW

When a company lacks an asset, people become a bottleneck. The bottleneck very well could be the founder or the owner of that business. Bottleneck then becomes a cash-flow blocker and limits growth

ANAND TAMBOLI
is a serial entrepreneur, speaker, award-winning author, and an emerging-technology thought leader

Many of you might know me from my days at Knewron Technologies. When I sold that company five years ago, it was a mixed experience. But one critical insight that I have gotten from that transaction remains a big one to this date with me. I realised I could have gotten a better value from it, only if I had built enough assets. It wasn't just my realisation, the buyers hinted at that too.

The point is income always follows assets. And that means, if you are intending to increase the value or valuation of your business, if you are intending to increase cash-flow in business, then having enough appropriate assets is going to be the key.

What's an asset?

In plain simple dictionary terms, an asset is something that is owned by a business, has value, and can be used to generate income or provide future economic benefits.

Assets can be tangible, such as property, equipment, tools, inventory, etc, or intangible, such as patents, designs, trademarks, copyrights, goodwill, investments, and so on.

Tangible assets are easier to recognise, understand, and evaluate. However, intangible assets are often difficult to understand and so to evaluate. Nonetheless, many of us can recognise them easily.

> WHEN A COMPANY LACKS AN ASSET, PEOPLE BECOME A BOTTLENECK.

Assets are important to businesses because they can be used to generate income, support operations, and provide value to the business. When it comes down to the assessment of their value or cash flow by the bank or investors, assets play a crucial role. They become a key factor in determining the right value of a business.

Especially for small businesses or startups, assets are like a lifeline. Assets being one of the most important things, founders, entrepreneurs, and business owners must pay attention to creating them.

Startups and small businesses

The obvious question you might now have is, why am I mixing startups and small businesses? Isn't there a difference in what they do? Well, it's not that simple.

Startups and small businesses are similar in that they are both small companies. The key difference is that startups are often focused on developing and bringing a new product or service to market and may be riskier than small businesses. Small businesses, on the other hand, are focused on providing products or services that are already in demand and may be more stable and less risky.

Despite these differences, startups and small businesses share some key similarities. Both are usually owned and operated by a small team or an individual, and they both have a limited budget and resources. Both startups and small businesses are also subject to the same laws and regulations as larger companies, and they both face similar challenges as they try to grow and succeed.

The key issue

When it comes to assets, both startups and small businesses are likely to fail the test. They don't have enough assets. Their constant state of flux is indicative of the absence of assets.

A good rule of thumb is, when a company lacks an asset, people become a bottleneck. The bottleneck very well could be the founder or the owner of that business. Bottleneck then becomes a cash-flow blocker and limits growth.

So, think about your business. Does it have bottlenecks? Are they just a few or many?

Why assets are important

Having assets brings several benefits. The first and foremost thing you do with an asset is to generate income. Whether it is a piece of equipment or inventory, or goods or services that can be produced and sold to generate income for the business. These assets are necessary for the day-to-day operation of a business. Without them it becomes difficult for the business to function.

Even with intangible assets like patents, branding, and goodwill, business ideas are protected, and market share is protected. Which is important for generating sustained income.

But one of the most ignored or underestimated facts about assets is their use in valuation. Assets are a key factor in determining the value of a business. The value of a business's assets, including tangible and intangible assets, is often included in the overall valuation of the business. In fact, this is what happened during the sale of Knewron, which brought down its valuation drastically.

Assets help a business generate income, support

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operations, provide value, and contribute to the overall value of the business.

If we look from the scalability perspective, assets help here too. For example, assets like property or equipment can be utilised to increase production to meet demand. If a small business or startup wants to branch out to another location or territory, its branding assets help a lot in establishing a foothold.

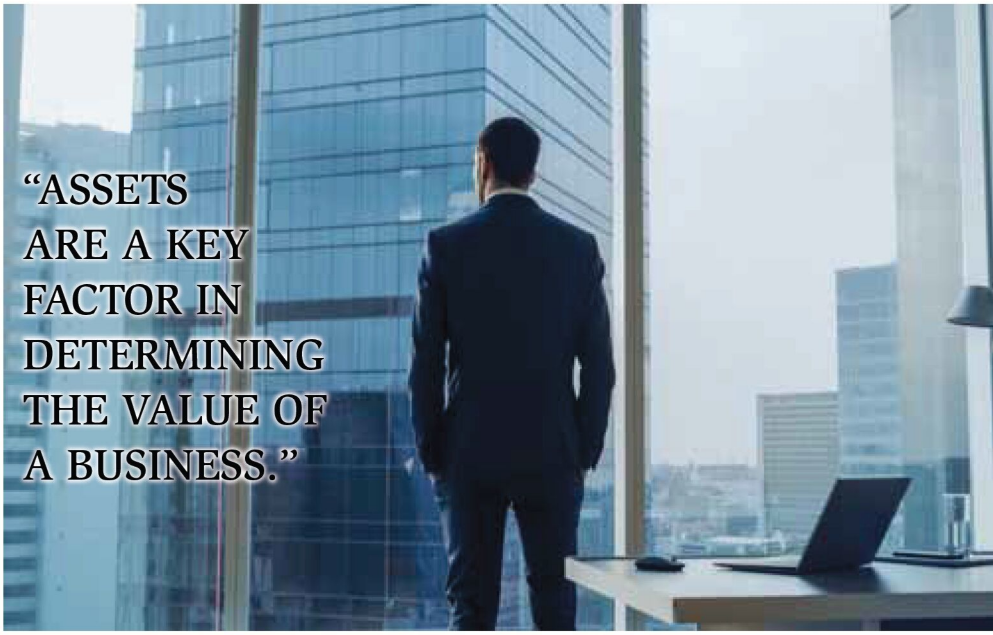
However, the most important benefit of having assets I can think of is to free up the founder's or owner's valuable time. People do not remain a bottleneck anymore. It also creates the elasticity in business and the business model grows, which then makes the business scalable.

A few things you can do today

As building several key assets is the same as building a business, it is going to take quite some time. However, there are a few urgent things you can do starting today that will help make your position much stronger over the period.

1. Assess what you have or don't have. As always, whenever you see a problem, instead of jumping to solutions, diagnosis of the problem helps better. So, assess what assets you have already. Apply one simple principle to do this assessment—ask yourself, where are my bottlenecks and how do I often solve them? Things that are not linked to your time and help you relieve are likely to be your existing assets. Of course, there are more, and we will cover them subsequently.

> REMOVING BOTTLENECKS MAKES BUSINESS MORE SCALABLE.



> "ASSETS ARE A KEY FACTOR IN DETERMINING THE VALUE OF A BUSINESS."

2. Lay down the strategy to maximise what you have. In business, there are problems, and there are "good problems." And we all know what those "good problems" are, right? Not having assets is a problem, while having that push us towards solving it is a "good problems." So, lay down your strategy and plan how to maximise use of the existing assets.

3. Create a roadmap for creating what you don't have. But more importantly, fixing the lack of assets should be your top priority. This also means you got to have a roadmap for creating them. Once you know what is missing, create a roadmap to build it.

4. Think about formalising and commercialising them. This is not something you can do immediately or in the near term. However, thinking about it now is important. As you start building business assets, tangible and intangible, you will want to formalise them as you go. Eventually, it will only be logical to commercialise them. All this should be on your to-do list today.

5. Avoid being too close to your business. You know, when you stand close to the TV screen, it's nearly impossible to see anything; you cannot appreciate the beautiful motion pictures being shown. The reason is simple, you're too close to it. And that's what happens when we lose perspective.

Taking a step back and seeing the bigger picture for your business often requires facilitation from an expert in a fresh new environment. You need new perspectives and creative insights. There is a difference between "working in" your business and "working on" your business. The goal should be to "work on" your business.

About the series

If you have understood the importance of building meaningful assets, it would make sense to take you on a journey and explain them further. On this journey, I will explain more about the type of assets and the key principles to build them. And to do that this series of articles is going to be the key.

I will be covering a range of topics that are essential for entrepreneurs who want to take their businesses to the next level. That is where this series is going to help you with that most needed perspective and insights. EFY

INDUSTRY NEWS

INDUSTRY UPDATES

Consumer electronics industry foresees double-digit growth in 2023

India's appliances and consumer electronics sector (ACE) expects the double-digit growth trajectory to continue in 2023, as companies seek to expand capacity and roll out new-age smart products. ACE industry body Consumer Electronics and Appliances Manufacturers Association (CEAMA) said that it was "optimistic about good growth in 2023 as well" and expected to double the value of the industry in the next three years to ₹1,480 billion by 2025 as well as make the country an alternative hub for exports.

Representational image

Government to launch PLI scheme for high-end components

The Ministry of Electronics and IT (MeitY) is planning to launch a production-linked incentive (PLI) scheme worth ₹100-120 billion to promote domestic manufacturing of high-end components for smartphones and other IT hardware. As per reports, the incentive scheme aims to build an ecosystem of local electronics manufacturing in India to attract global tech giants.

PEOPLE (on the move)

Pathy Iyer heads sales and marketing for Liquid Instruments in India

Pathy Iyer has been appointed as Director of Sales and Marketing for India. Iyer has nearly three decades of experience as a leader in the test and measurement field. He recently retired from Keysight Technologies, where he served the education and research sectors. Iyer is tasked with the challenge to grow sales of Liquid Instruments in India.

TPV Tech appoints Atul Jasra as Country Head in India

Hong Kong based monitor and LCD TV maker TPV Technology has announced the elevation of Atul Jasra as the new Country Head in India. Till the announcement, Jasra served the brand as its business head and spearheaded the business and sales for AOC monitors, smartphones, tablets, and LED TVs for India and SAARC. He will be responsible for developing and executing strategic plans to achieve sales targets and expand the customer base in India.

Bel Fuse appoints Suzanne Kozlovsky as Global Head of People

Global connector manufacturer Bel Fuse Inc. has appointed Suzanne Kozlovsky as the Global Head of People to manage associate engagement, development, talent retention strategies, and compensation structure. Before starting at this newly created executive-level position, Kozlovsky worked as Vice President of Human Resources for Prinova, a Nagase Group company. Bel Fuse said that the newly created position would empower the global connector maker in its cultural transformation journey.

New Digital Competition Act tabled in Parliament

The Parliamentary Standing Committee on Finance has stressed the need for a new Digital Competition Act to prescribe a code of conduct for tech giants so that they do not stifle competition with their market power. It listed a set of undesirable practices observed in the digital economy, such as e-commerce platforms pushing their own private labels over third-party brands sold on the platform. They were found using customers' personal data to get ahead of the competition and bundling different products and services. So, the committee said that a code of conduct based approach was needed for digital market winners called digital market gatekeepers.

NRDC to do tech commercialisation for startups

Union Minister Dr Jitendra Singh recently stated that from January 2023 National Research Development Corporation (NRDC) is undertaking technology commercialisation for the benefit of startups. It is noteworthy that the minister presided over a meeting with the Secretary, DSIR and other senior officials of NRDC at the CSIR Centre in New Delhi. Dr Jitendra Singh remarked that since its inception, NRDC has concluded over 5,000 licence agreements representing technologies in almost all industry sectors.

Calendar of Forthcoming Electronics Fairs/Exhibitions/Seminars/Events

Event, Date and Venue	Topics	Contact address for details
Embedded World March 14-16, 2023 Nuremberg, Germany	The Embedded World exhibition and conference provides a global platform and insight into the world of embedded systems, from components and modules to operating systems, hardware and software design, M2M communication, services, and various issues related to complex system design.	Website: https://www.embedded-world.de/en
Electronics For You Tech Expo March 24-25, 2023	Pune is one of India's fastest growing electronics and automotive regions. The Pune-Nasik-Mumbai triangle represents a market that's not been tapped by any major electronics event yet. Hence, Electronics For You team is taking the initiative to launch EFY Expo @ Pune. The expo is powered by MOVES—a unique conference targeting mobility, automotive, and EV sectors.	Website: https://www.electronicsforu.com/events/electronics-for-you-tech-expo
Open Source India 2023 October 12-13, 2023 NIMHANS Convention Center, Bengaluru	Open Source For You magazine, in partnership with India's Open Source community and industry, brings various stakeholders under one roof to accelerate development and deployment of open source in India, and beyond.	Website: https://www.opensourceindia.in
India Electronics Week February 7-9, 2024 KTPO, Whitefield, Bengaluru	India's No. 1 event for creators of smart electronics solutions to discover latest techniques, best practices and technologies for developing electronics better, cheaper and faster, and meet service providers, suppliers and partners who can enable growth of your business.	Website: www.indiaelectronicsweek.com
IoTShow.in 2024 February 7-9, 2024 KTPO, Whitefield, Bengaluru	The conferences and hands-on workshops, cutting-edge talks and trainings by industry stalwarts and thought leaders will help build the skills you need to get ahead in the field.	Website: https://www.iotshow.in

Since this information is subject to change, all those interested are advised to ascertain the details from the organisers before making any commitment.

SMEV alleges misappropriation of subsidies under FAME II scheme

In a major development in the EV sector, the Society of Manufacturers of Electric Vehicles (SMEV) recently hit out at the Central government for alleging the misappropriation of subsidies under the FAME India Phase II scheme. Union Minister Mahendra Nath Pandey told the Parliament that the ministry received complaints regarding the misappropriation of subsidies under the FAME India Phase II scheme by some EV makers. In a response to this, SMEV Secretary General Ajay Sharma said that the allegation is "invalid in the context of the issue at hand." Notably, as per the scheme, electric two-wheeler makers are required to have at least 50% localisation of components to avail of the subsidy.

REIL awards contract for 253 EV chargers for highways

Rajasthan Electronics & Instruments Ltd (REIL) has awarded a contract to supply 253 fast EV chargers to Statiq—a leading provider of EV charging services. These chargers will be deployed at four key under-construction highways connecting Agra-Lucknow, Meerut-Gangotri, Chennai-Bellary, and Mangaldai-Wakro. The company said that it will ensure an affordable, accessible, and reliable four-wheeler charging network. While this is an outright sale, Statiq will maintain the overall quality and upkeep of the equipment for the next three years.

IIT Guwahati students craft multipurpose smart drones

Seen as a major achievement by the Indian academic community, the students of the Aeromodelling Club of IIT Guwahati have indigenously designed and developed four state-of-the-art drones in collaboration with their professors. These 'multipurpose' drones are capable of surveillance, precision photography, and warehouse management.

Micromax's Bhagwati Products gets money under PLI scheme

Consumer electronics maker Bhagwati Products Ltd has received a disbursement of ₹53 million from MeitY under the production-linked incentive (PLI) scheme for IT hardware. The smartphone manufacturer, whose parent company is Micromax, has become the first domestic company to receive the disbursement after it qualified incremental sales thresholds and investment criteria.

Sahasra Electronics to manufacture chips for Sparsh CCTV

Rajasthan based electronics maker Sahasra Electronics will indigenously manufacture memory chips and solid state drives (SSDs) for Indian CCTV and surveillance systems designer and manufacturer Samriddhi Automations Pvt Ltd's Sparsh CCTV. The two companies have signed an MoU in this regard. In July 2022, Sahasra announced an investment of around ₹7.5 billion to establish a manufacturing unit in Bhiwadi, Rajasthan, for outsourced semiconductor assembly and testing (OSAT) of ICs. Sahasra will focus on memory ICs and subsystems in the first phase.

SNIPPETS

- TML CV Mobility Solutions Ltd, a Tata Motors subsidiary, has signed a definitive agreement with Delhi Transport Corporation (DTC) for the operation of 1,500 e-buses in New Delhi.
- Indian e-scooter manufacturer Ather Electric has reported an incredible growth of 389% YoY in its December 2022 sales.
- Having sold almost 150,000 EVs in 2022, Ola said that it will have six different products in the market by 2027, including two e-motorcycles.
- Delhi government recently approved its draft Solar Policy 2022 to increase the share of the city's annual electricity demand met by solar energy from 9% (now) to 25% by 2025.
- US based chip supplier ON Semiconductor Corp (onsemi) announced that its latest silicon carbide power modules will be used in Kia Corporation's EV6 GT model.
- Panasonic has announced its 'Take Back for Tomorrow' programme in North America to promote the recycling of certain consumer electronic devices.
- Tech Mahindra has signed an MoU with Tagawa City in Japan to accelerate digital transformation by leveraging 5G, IoT, AR & VR, and upskilling the local talent.

Eicher Motors to invest in European e-bike maker

Amid the ever-increasing craze for EVs, India based Eicher Motors has announced an investment of ₹44,143 million and acquire a 10.35% equity stake in electric motorcycle maker Stark Future. Notably, the Spain based e-bike manufacturer Stark Future recently launched its first high-performance electric motocross bike Stark Varg. The parent of Royal Enfield, Eicher, mentioned in a statement that the investment is aimed at forming a long-term partnership between the two firms for collaborative research and development in electric two-wheelers, technology sharing, technical licensing, and manufacturing.

APSCHE and ESSCI to launch electronics and IT industry programmes

Andhra Pradesh State Council of Higher Education (APSCHE) has signed an MoU with the Electronics Sector Skills Council of India (ESSCI) to launch new-age industry-integrated programmes in the electronics and IT sectors at the APSCHE office in Mangalagiri. APSCHE announced that this MoU

ANDHRA PRADESH
STATE COUNCIL

INTERNATIONAL news

US to expand list of countries for EV credit eligibility

The US Department of the Treasury said that countries other than the US and its free trade agreement partners may be added to the Inflation Reduction Act as places of production eligible for US EV credit. The existing rules of the IRA suggest that for any EV maker to be eligible for the credit, the product needs to undergo final assembly in North America. It allows the imports of critical minerals from countries with free trade agreements to still qualify for incentives, but not imports of battery components. The law forbids tax credits for vehicles with any components or critical minerals sourced from a "foreign entity of concern," such as China or Russia.

Samsung plans to raise chip production in 2023

As per various reports, Samsung Electronics intends to raise semiconductor chip production capacity in 2023 at its largest semiconductor plant in South Korea amid forecasts of an economic slowdown. The company plans to expand its P3 factory in Pyeongtaek by adding a 30.4cm (12-inch) wafers capacity for dynamic RAM (DRAM) memory chips. Earlier, Samsung announced the development of its 16GB DRAM using the industry's first 12nm-class process technology.

Foxconn partners with Nvidia to build autonomous vehicles

Electronics contract manufacturer Hon Hai Technology Group (trading as Foxconn Technology Group) has partnered with graphics semiconductor chip manufacturer Nvidia to develop automated and autonomous vehicle platforms. Foxconn will be producing cars based on Nvidia's DRIVE Orin electronic control units (ECUs) and DRIVE Hyperion sensors. Nvidia's DRIVE Hyperion sensor is a modular development platform and reference architecture for designing autonomous vehicles. The automotive-grade NVIDIA DRIVE Orin system-on-chip (SoC) achieves up to 254 trillion operations per second.

Baidu and Pony.ai to test autonomous robotaxis without safety backup

Baidu Inc. and Toyota Motor Corp backed startup Pony.ai will soon be testing fully autonomous vehicles without safety operators as a backup in Beijing. The two companies are among the first to be granted licences to offer commercial robotaxi services in China's capital. The two companies said they would test ten driverless vehicles in a technology park developed by the Beijing government. Chinese regulations currently allow Level 4 autonomous driving capability, which does not require a human driver to control the vehicle, in robotaxis that operate within designated geofenced areas.

TSMC announces mass production of 3nm chips in Taiwan

Taiwan Semiconductor Manufacturing Company (TSMC) has announced mass production of its 3nm chips in Southern Taiwan. The company's chairman said it would continue to expand capacity on the island. The 3nm chips are considered to be the most advanced chips produced by TSMC, which will outperform the 5nm chips found in the latest Pro iPhone models. This announcement comes six months after Samsung achieved 3nm production.

Kyocera to double CAPEX and R&D expenditure over next three years

Japanese electronics maker Kyocera Corp intends to double its total capital investment (CAPEX) and research and development expenditure to $9.78 billion over the next three fiscal years through March 2026 to expand its manufacturing capabilities. As per reports, Kyocera doubled the amount spent during the past three years to March 2023 to fund the expansion of parts such as ceramics for chip-making equipment. It plans to spend up to $6.728 billion on CAPEX, which is double the amount it has spent over the past three years.

Samaiden launches rooftop solar PV project at Sunway Nexis

Samaiden Group Berhad, a clean energy solution provider, announced that their wholly-owned subsidiary Samaiden Capital Management Sdn Bhd's first solar investment project at Sunway Nexis commenced operation in late December. Samaiden will operate and maintain the rooftop solar PV system with an installed capacity of 531 kilowatt-peak (kWp) for a duration of 20 years. It believes that around 8,400 tonnes of carbon emissions can be reduced, owing to the generation of 12.5 million kilowatt hours (kWh) of energy over the 20-year period.

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Taiwan chipmakers can turn 25% of R&D expense into tax credits

Taiwan has passed new rules that allow local chip firms to turn 25% of their annual research and development expenses into tax credits to retain the island's dominance in the semiconductor market. The new incentives are expected to be brought into effect sometime in 2023. Chip companies in Taiwan can also claim tax credits on 5% of the annual costs of buying new equipment for advanced process technologies, the ministry said.

Aries and Emdalo team up to develop RISC-V and FPGA modules

Germany based Aries Embedded has partnered with Emdalo Technologies to develop embedded modules based on Microchip's PolarFire RISC-V SoC and FPGA architecture. The PolarFire FPGA architecture, used by Aries, includes multiple embedded RISC-V processors for its M100PF and M100PFS system-on-modules (SoM). These are already used in a range of applications, including smart embedded vision, industrial automation, communications, and IoT. The M100PF SoM family implements the PolarFire FPGA that spans from 100K logic elements (LEs) to 300K LEs. It features 12.7G transceivers and needs up to 50% lower power than competing mid-range FPGAs.

is to set up a working relationship between the two organisations to build "for industry, by industry" focused and advanced digital skills learning programmes, facilitate on-the-job training, internships/apprenticeships and employment opportunities, promote innovation, product development, and startup ecosystem.

Samsung R&D Institute launches Samsung Innovation Campus

Samsung R&D Institute Bangalore (SRI-B) recently inaugurated their Samsung Innovation Campus at the Cambridge Institute of Technology (CIT) in Bengaluru to upskill youth in future tech domains such as artificial intelligence, the Internet of Things, big data, and coding and programming. As a part of this initiative, engineers from SRI-B will mentor the faculty at CIT to bridge the industry-academia gap. Through the integration of technology, basic software skills, and emerging capabilities, the programme seeks to empower its participants to grow into well-rounded professionals.

SAMSUNG
Samsung Innovation Campus

Gogoro and Belrise form JV with Maharashtra for EV charging stations

The state government of Maharashtra has entered into a $2.5 billion partnership with Taiwanese company Gogoro Inc. and local supplier Belrise Industries to build EV battery-swapping and charging stations in the state. Gogoro and Belrise Industries, an Indian automotive systems manufacturer, will have equal stake in the joint partnership to form an infrastructure company to own the batteries and swapping stations in Maharashtra, according to Gogoro's CEO and co-founder Horace Luke.

Garuda's drones to spray Rallis pesticides and nutrients in agri-fields

India's leading drone manufacturer, Garuda Aerospace, recently signed an MoU with a major agriculture industry player and a subsidiary of Tata Chemicals, Rallis India Limited. Rallis will supply pesticides and crop nutrients to Garuda Aerospace, which will use drones to spray those on fields under a pilot demonstration in Maharashtra and Andhra Pradesh. The two companies suggested that the partnership will work for the betterment of the farmers by leveraging technology in their agricultural operations and enabling businesses to achieve their sustainability goals by helping drive the efficient use of resources.

Honeywell and Nexceris to develop lithium-ion gas detection solutions

Honeywell's Indian subsidiary has partnered with energy solutions provider Nexceris to develop lithium-ion gas detection solutions to make EVs safer. The collaboration aims to develop an advanced suite of battery monitoring sensors to help automotive manufacturers strengthen their battery health monitoring systems with the ability to detect thermal runaway conditions even earlier than before.

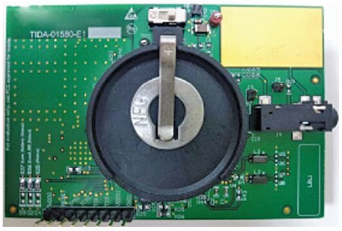
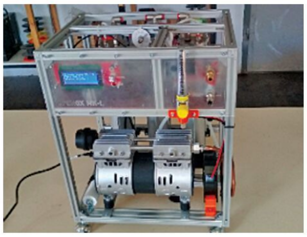
Turno and Etrio to deploy 1,000 e-3-wheelers in one year

EV financing platform Turno recently entered into a long-term strategic alliance with commercial EV manufacturer Etrio Automobiles to deploy 1,000 e-three-wheelers pan-India in a one-year time period. The EV maker stated that the deployment of these vehicles will start in cities like Delhi, Hyderabad, and Chennai, where both Etrio and Turno have a strong presence. They would then eventually expand to other parts of the country.

Saera Electric Auto to manufacture for ETO Motors

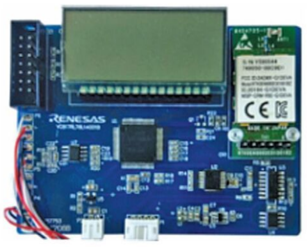
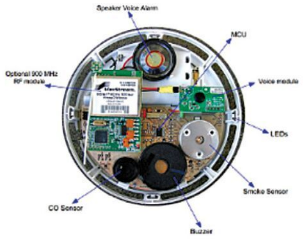
In the latest development in the Indian EV world, Saera Electric Auto entered into a contract manufacturing agreement with electric mobility provider ETO Motors, which has a manufacturing facility in Hyderabad. The collaboration will help ETO expand its micro-assembly strategy for better regional deployment efficiencies. The partners will cooperate in the development of battery solutions for vehicle brands beyond ETO. As per the terms of the partnership, ETO Motors EVs will be manufactured at the Saera Electric Plant in Bawal, Haryana.

5 Interesting REFERENCE DESIGNS

Title of Reference Design	Reference Design for ECG, SpO2, PTT, and Heart Rate Monitor	Reference Design for Oxygen Concentrator
Image		
Key Attraction	Reference design for a compact wearable device that enables ECG (electrocardiography) and PPG (photoplethsymography). It can also share raw data for SpO2, heart rate, and PPT (partial thromboplastin time). It can work for up to 30 days on a single cell.	Reference design for an open source oxygen concentrator based on molecular sieve and pressure swing adsorption technique. This open source oxygen concentrator can give a maximum oxygen flow of 6 litres per minute (LPM).
Highlights	TIDA-01580-E1 from Texas Instruments (TI) is a reference design of a simple, wearable, multiparameter, patient monitor that is powered by an ARM Cortex M3 microcontroller (MCU). The design employs AFE4900—a single-chip, biosensing front end for measuring synchronised electrocardiography (ECG) and photoplethysmography (PPG). It integrates a CC2640R2F, which adds Bluetooth connectivity to the reference design and also features a 2.4GHz RF transceiver that enables wireless data transfer through BLE 4.2 and 5.0. Apart from measuring ECG and PPG the reference design also provides raw data to calculate SpO2, heart rate, PPT, etc. The reference design features four LEDs and three photodiodes, with digital ambient subtraction to improve the signal-to-noise ratio (SNR). The small form factor and low power requirement make it suitable for implementation in various wearable applications. It can work for up to 30 days with a single cell.	The OpenOx is an open source hardware oxygen concentrator developed primarily by Hacklab, a community-supported hackerspace and improved by various individual contributors. This open source oxygen concentrator design can give a maximum oxygen flow of 6 litres per minute (LPM) with an oxygen concentration level ranging from 85% to 95% while consuming merely 580W of power. The OpenOx concentrator uses a molecular sieve and pressure swing adsorption methodology to produce the oxygen gas output. The oxygen concentrator has an air compressor, two cylinders filled with zeolite granules, a pressure-equalising reservoir, and some valves and tubes. It has a simple design and is optimised for fast production. The module weighs about 20kg and measures 550mm x 400mm x 300mm. All the software of the reference design is released under GNU General Public License V3, and all the hardware are under the CERN Open Hardware License.
Application	The module is suitable for use as a wearable in patient monitoring devices.	This reference design can be used to generate oxygen for patients in hospitals and at homes.
OEM Brand	Texas Instruments (TI)	Hacklab + individual contributors
URL	https://www.electronicsforu.com/electronics-projects/electronics-design-guides/reference-design-for-ecg-spo2-ptt-and-heart-rate-monitor	https://www.electronicsforu.com/electronics-projects/electronics-design-guides/reference-design-for-an-oxygen-concentrator

For Medical And Environment Sensing Applications

The author, Sharad Bhowmick, works as a Technology Journalist at EFY. He is passionate about power electronics and energy storage technologies. He wants to help achieve the goal of a carbon neutral world.

Reference Design for Handheld TDS Meter	Reference Design for Smart Body Fat Scale	Reference Design for CO Detector
		 Speaker Voice Alarm MCU Optional 900 MHz RF module Voice module LEDs Smoke Sensor CO Sensor Buzzer
Reference design for a handheld TDS (total dissolved solids) meter that employs direct measurement of conductivity of the solution to detect the TDS.	Reference design for a smart body fat scale that can display body weight, body mass index (BMI), body fat percentage, and body impedance.	Reference design for a carbon monoxide (CO) sensor that can measure amount of CO and smoke particles in the atmosphere and alert the users when the level of CO particles becomes dangerous.
CN0411 from Analog Devices (ADI) is a reference design for a compact total dissolved solids (TDS) measurement system. The TDS monitor uses the direct measurement of the conductivity of the solution technique to detect TDS. The main advantage of this design is that it uses a standard BNC probe connection, making it both faster and cheaper to design. The frequency of the excitation in this design is controlled by a PWM signal from the microcontroller. The reference design is also Arduino form-factor compatible. For higher accuracy, the reference design also has a temperature compensation that is performed using either a 100Ω or 1,000Ω 2-wire RTD. The design is capable of measuring low to high conductivity levels ranging from 1μs to 0.1s and can accommodate 2-wire conductivity probes of different cell constants from 0.01 to 10.	This Smart Body Fat Scale from Renesas is a reference design capable of measuring weight and displaying complete information about your body composition. The reference design includes four weighing sensors along with four metal electrodes for body impedance measurement. The reference design employs a Renesas RL78/L1A microcontroller (MCU) that adds Bluetooth connectivity to the device. The user needs to feed information such as height, gender, and age, while the weight and body impedance is measured by the smart scale. The MCU utilises all the above data to compute body fat percentage and other health parameters, which are displayed on an LCD monitor. Furthermore, the data is displayed on the smartphone application simultaneously. The smart body fat scale is suitable for healthcare bio-sensing applications.	This Carbon Monoxide (CO) Detector reference design from Zilog is based on electrochemical-cell sensor technology. The electrochemical sensors are more robust than any other CO detector. It is based on a Zilog's Z8 Encore XP microcontroller (MCU) and the Sixth Sense ECO-Sure (2e) CO sensor. The on-chip integrated hardware of the MCU minimises the board space with very few external components. The MCU also implements a power management routine to conserve power. An optional 900MHz RF module can be added to the reference design that can add wireless networking and monitoring features, making it suitable for various applications. This unit runs on three AA-size batteries and has a blinking LED indicator to indicate the status of the detector. With little modification, the design can be run using rechargeable lithium-ion batteries.
The reference design can be used for measuring the total dissolved solids (TDS) in water.	The reference design is suitable for measuring body composition.	The reference design is suitable for use as a CO sensor used in refineries, garages, homes, and waste-water treatment systems to make them safer.
Analog Devices (ADI)	Renesas	Zilog
https://www.electronicsforu.com/electronics-projects/electronics-design-guides/reference-design-for-a-handheld-tds-metre	https://www.electronicsforu.com/news/reference-design-for-a-smart-body-fat-scale	https://www.electronicsforu.com/electronics-projects/electronics-design-guides/reference-design-for-a-co-detector

EFY TESTED
Ashwini K. Sinha

ESP32 As
CAMERA WEBSERVER

SOMNATH BERA

This small-size programmable camera can start taking pictures when motion is detected and transmit real-time videos. It can be hidden easily for espionage work due to its tiny size.

The webserver camera can be designed in two versions. The first version described here can send real-time video over Wi-Fi. The author's prototype is shown in Fig. 1.

The software code required for this webcam server is made in Arduino IDE. So, we first need to install the ESP32 to Arduino IDE by opening Preferences and pasting the following link there: *https://raw.githubusercontent.com/espressif/arduino-esp32/gh-pages/package_esp32_index.json*

Next, open Board Manager, search ESP32 and install the board to Arduino IDE. After installing the latest Arduino IDE and selecting board for ESP32, if you go to "file→example→esp32→camera→webserver" you will see the ESP32 webcam project, which is already available there.

Upload the code to ESP32 cam and search the address of ESP32 cam in the web browser. You can see the live video from ESP32 cam.

Adding OLED display

In the original code of ESP cam there was no multiplicity of Wi-Fi network choices and there was no way to know the IP address of the webcam, unless it was connected to a PC to see the serial terminal output. So, you can modify the code and add the code for the ESP32 to automatically connect to the best available Wi-Fi among all the networks in range.

To modify, you need to replace the Wi-Fi SSID network names in the list and their passwords with your own Wi-Fi network's name and password. Then add the OLED display library in that. Next, get the IP address in the setup function and add the code line to display the IP address on the OLED display. The source code snippet is shown in Fig. 2.

BILL OF MATERIAL

Components	Quantity	Description
ESP32 with camera	1	ESP32 cam
OLED display (24.4mm)	1	SSD1306
USB-to-Serial FTDI chip	1	USB programmer
Battery/5V DC adaptor	1	Power supply
LM11173.3	1	Voltage regulator
Diode	1	1N4007
Capacitor C1	1	100μF, 10V

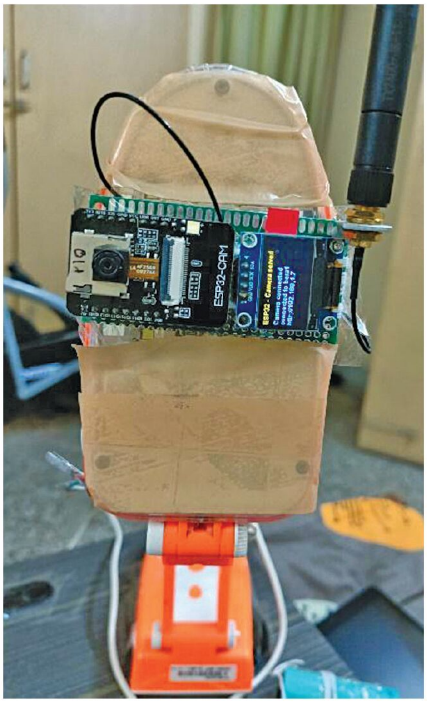
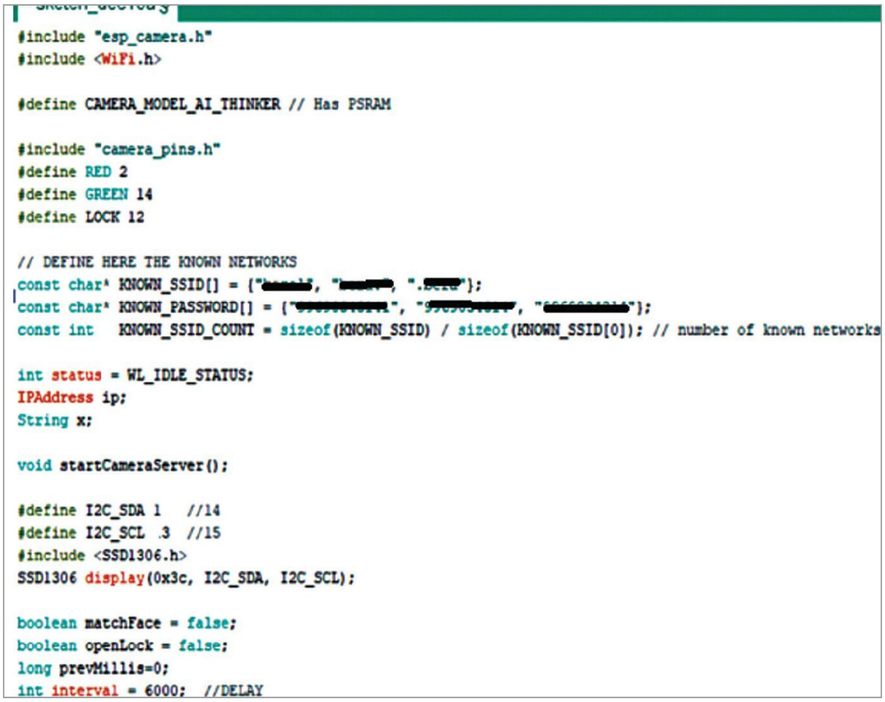


Fig. 1: Author's prototype



```
#include "esp_camera.h"
#include <WiFi.h>

#define CAMERA_MODEL_AI_THINKER // Has PSRAM

#include "camera_pins.h"
#define RED 2
#define GREEN 14
#define LOCK 12

// DEFINE HERE THE KNOWN NETWORKS
const char* KNOWN_SSID[] = {"[redacted], "[redacted], ".[redacted]"};
const char* KNOWN_PASSWORD[] = {"[redacted]", "[redacted], "[redacted]"};
const int   KNOWN_SSID_COUNT = sizeof(KNOWN_SSID) / sizeof(KNOWN_SSID[0]); // number of known networks

int status = WL_IDLE_STATUS;
IPAddress ip;
String x;

void startCameraServer();

#define I2C_SDA 1   //14
#define I2C_SCL .3  //15
#include <SSD1306.h>
SSD1306 display(0x3c, I2C_SDA, I2C_SCL);

boolean matchFace = false;
boolean openLock = false;
long prevMillis=0;
int interval = 6000;  //DELAY
```

Fig. 2: Code snippet for setting Wi-Fi SSIDs list and passwords

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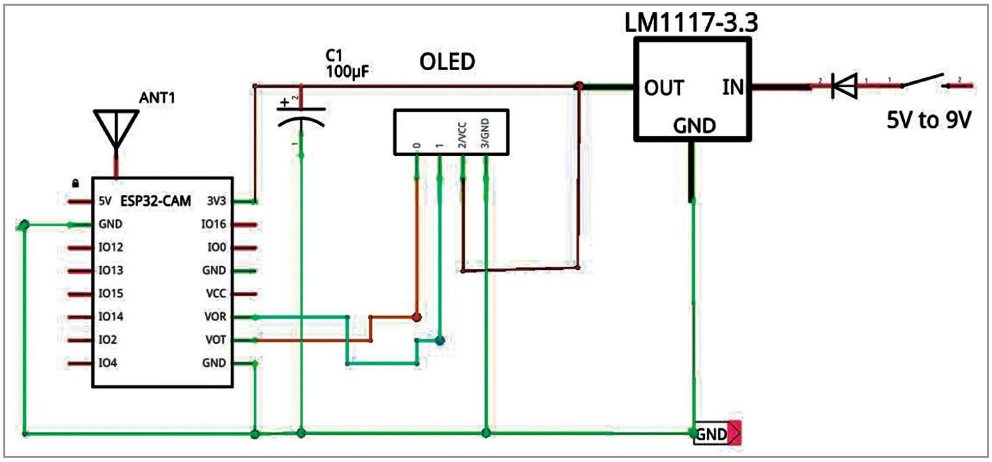
LM1117-3.3
C1
100µF
OLED
ANT1
OUT
IN
GND
5V to 9V
0
1
2/VCC
3/GND
5V
ESP32-CAM
3V3
GND
IO16
IO12
IO0
IO13
GND
IO15
VCC
IO14
VOR
IO2
VOT
IO4
GND
GND

Fig. 3: Circuit diagram of ESP32 camera webserver

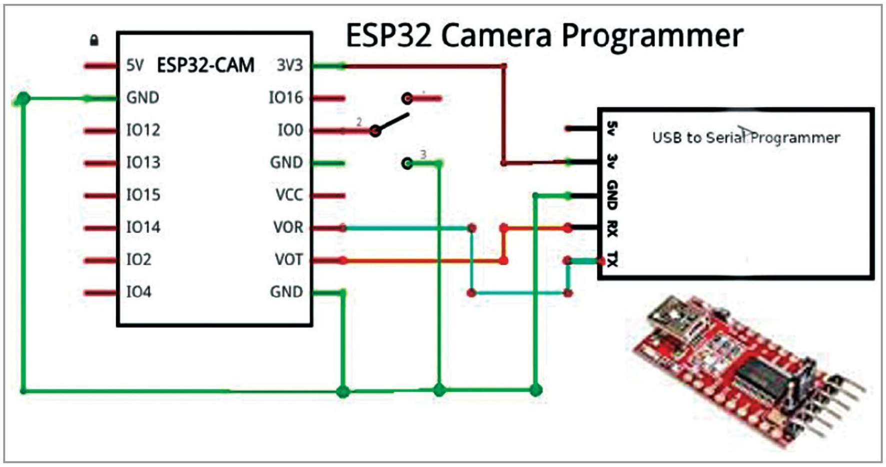
ESP32 Camera Programmer
5V
ESP32-CAM
3V3
GND
IO16
IO12
IO0
IO13
GND
IO15
VCC
IO14
VOR
IO2
VOT
IO4
GND
2
3
5v
3v
GND
RX
TX
USB to Serial Programmer

Fig. 4: Schematic of ESP32 cam programming

Circuit and working

The circuit diagram for ESP32 camera webserver is shown in Fig. 3. The circuit is built around voltage regulator LM1117, an OLED, and ESP32 cam. For programming ESP32 you need the USB-to-serial programmer shown in Fig. 4.

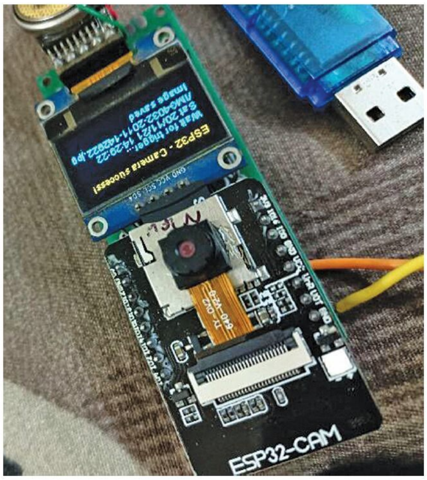

Fig. 5: Webcam with OLED to display

Software

The ESP32 camera does not come with built-in USB-to-serial interface. Therefore, to upload the sketch you need a USB-to-serial programmer. The schematic for the programmer is shown in Fig. 3.

The GPIO 0 pin is to be pulled to ground during uploading mode and reset button of the ESP32 needs to be pressed for first few seconds of uploading. After uploading the source code esp32-webcam-server.ino into ES32 board, remove the board and use it in the circuit.

The device can be powered using any regulated 5V DC adaptor, or a 6V battery, or a voltage regulator circuit. The SD card module on ESP board uses GPIO 4, GPIO 12, and GPIO 13. Only GPIO 1 and GPIO 3 are the free pins available, which can be used as serial pins for uploading the program in flash mode.

The GPIO1 and GPIO 3 pins are free after uploading the program, so we can use them as I2C pins for connecting the OLED display.

Construction and testing

Upload the source code esp32-web-cam-server.ino into ESP32 as described above. Assemble the circuit as per Fig. 2. On powering the device to connect it to the Wi-Fi available in the network, it will show the IP address on the OLED display connected to it.

Now open any web browser in your smartphone or laptop and search the IP address displayed on OLED display. You should be able to see the live video on your phone/laptop. The webcam with OLED to display its network name and IP address is shown in Fig. 5.

The low-cost ESP32 camera has wide possibilities because it is programable. By fixing a series of these cameras in line, we can get a wide object scanner of 50 to 100 metres for taking pictures of approaching vehicles' number plates to check for over speeding. In solo mode, with a PIR sensor, it can be used as a bird snap catcher. For safety against Covid, it can be used as a scanner for high temperature detection. EFY

EFY Note

The source code of this project is available for free download at *www.electronicsforu.com*

Somnath Bera, General Manager at NTPC, is an IoT and electronics enthusiast

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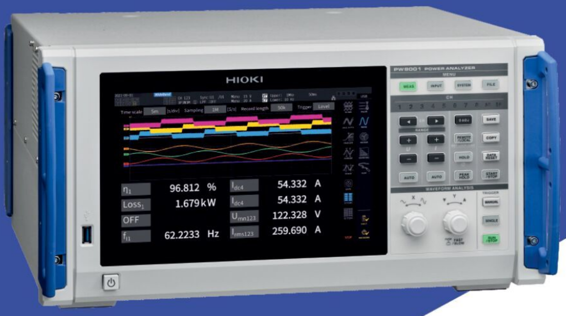
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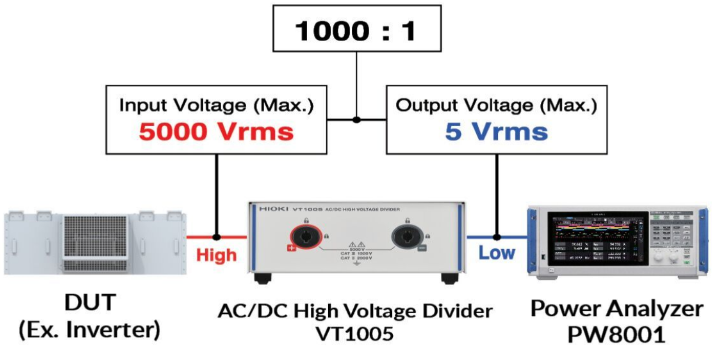

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EFY Expo 2023 (www.efyexpo.com)	7
EFY Group of Publications: Subscription Scheme (https://subscribe.efy.in)	37
Elcina Electronic Industries Association of India (www.elcina.com)	29
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element14 India Pvt Ltd (https://in.element14.com)	Front Cover
HIOKI INDIA PRIVATE LIMITED (https://www.hioki.com/global)	71
India Electronics Week (http://www.indiaelectronicsweek.com)	75
Jet Technologies (http://www.jetffc.com)	41
Kioxia Singapore Pte. Ltd (https://www.kioxia.com)	53
KYOCERA Asia Pacific India Pvt Ltd (https://asia.kyocera.com)	35
Liquid Instruments (Australia) (https://www.liquidinstruments.com)	27
LWI Electronics Inc. (www.livewireinfo.com)	23
Millennium Technologies (www.milltech.in)	73
MORNSUN GUANGZHOU SCIENCE & TECHNOLOGY CO., LTD (https://www.mornsun-power.com)	9
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Premier Industries (www.solderwire.co.in)	72
RECOM Asia Pte Ltd (https://recom-power.com)	47
Sakthi Accumulators Pvt Ltd (https://sakthipower.com)	73
Sanjay Technologies (www.sanjaytechnologies.co.in)	59
Spur DTDS Microwave Pvt Ltd (www.pasternack.com)	49
THOTAKA TEKHNOLOGIES INDIA PRIVATE LIMITED (www.thotakaa.com)	43
Videon Industries (https://videonshop.in)	73

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